611-132

VIKING 75 ORBITER
SYSTEM TEST AND LAUNCH OPERATIONS
FINAL REPORT

VOLUME 1: SYSTEM TEST

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Approved:

R. F. Collins
Orbiter Test and Operations Manager

A. E. Wolfe
Orbiter Spacecraft Manager

H. W. Norris
Viking Orbiter Manager

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA

ACKNOWLEDGMENT

The Viking Orbiter test and launch program was successful because of the contributions of too many people to list. The following key people stand out: A. E. Wolfe, Orbiter Spacecraft Manager; W. J. Castellana and W. K. Moore, test chiefs; T. J. Laney, mechanical engineer; H. Fitzhugh, test engineer; J. C. Beckert, support; C. Ashley, documentation. Most of the Volumes 1 and 2 were assembled and written by N. Eddy from sparse and scattered source material.

R. F. Collins

CONTENTS

SECTION I
INTRODUCTION

A. SCOPE

This document, the Viking 75 Orbiter System-Test and Launch Operations Final Report, describes the activities and results of the test and operations program performed on the three orbiter spacecraft (VO-1, VO-2, and VO-3). The document is in two volumes:

Volume 1: System Test Report covers the period from receipt of orbiter hardware at the Spacecraft Assembly Facility (SAF) at JPL through shipment of the orbiter systems and support equipment to the Air Force Eastern Test Range (AFETR).

Volume 2: Launch Operations Report covers the period from shipment of the orbiter systems and support equipment to the AFETR through launch of the flight spacecraft (VO-1 and VO-2).

B. BACKGROUND

Project plans originally called for fabrication and assembly of four orbiters: a Proof-Test Orbiter (PTO), two flight units, and a flight spare. Prior to system testing, the orbiter program was reduced to a PTO/spare (VO-1) and two flight units (VO-2 and VO-3).

Initial assembly of the PTO began Jan. 2, 1974 (see Figure 1) in the SAF at JPL. Most of the inspection, assembly, and testing of the orbiters was conducted there. Beginning activities around the PTO included layout of the System Test Complex (STC) cables and raised floor, and connection and checkout of the test racks. As PTO subsystems became available, a series of interface and integration tests took place, starting with power-to-system cabling.

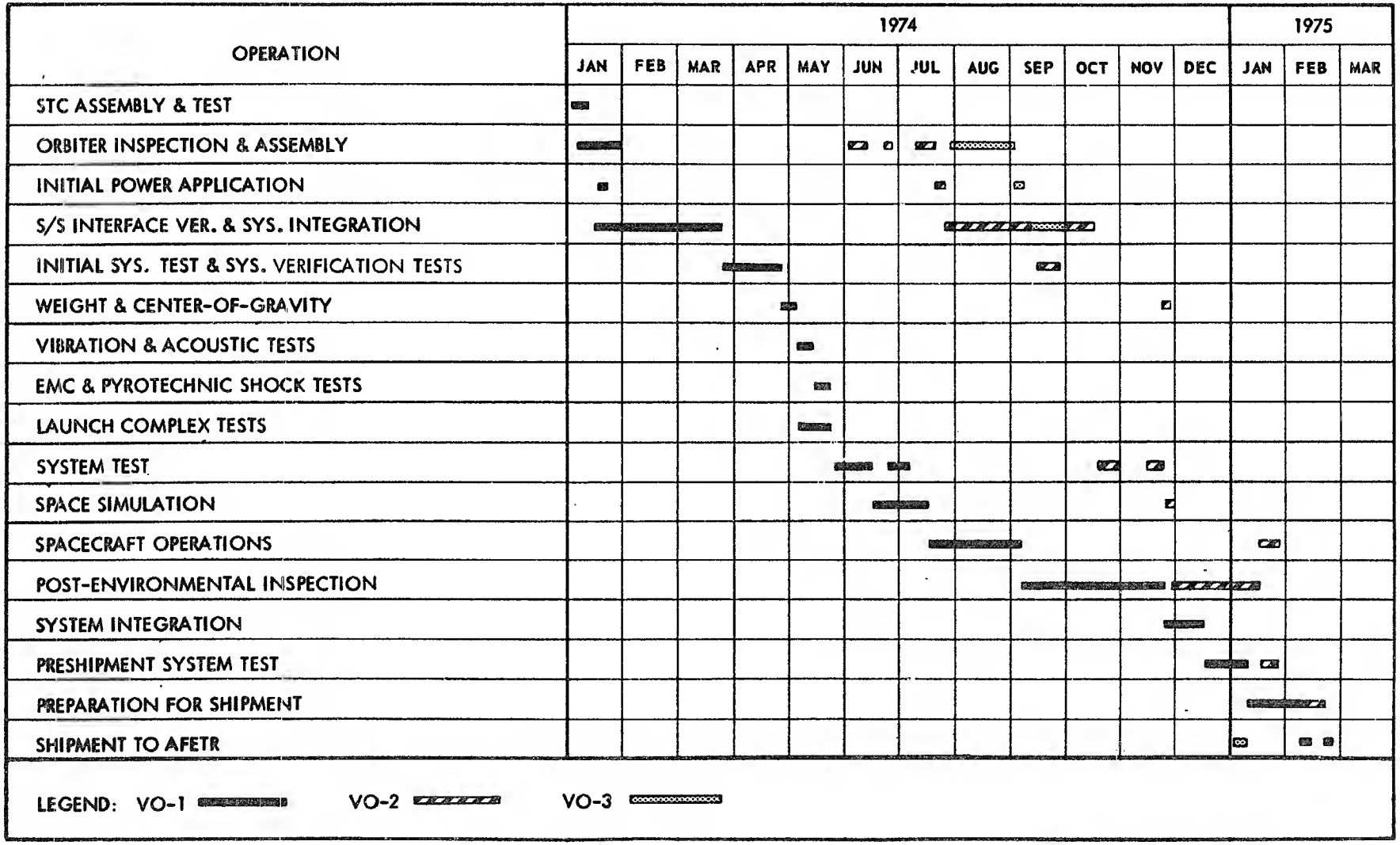


Figure 1. Viking 75 Orbiter System Test Calendar

Procedures in this phase detailed the pin-by-pin connection and verification of all interfaces. As various subystems were added on-board the PTO and bugs were eliminated, major mission modes were analyzed. By April, 1974 a sufficient amount of breadboard and prototype hardware had been installed, tested, and integrated with the STC to warrant an initial system test.

The system test was designed to verify all the elements of a nominal mission profile (see JPL Document VO75-3-120). In order to verify primary, secondary, redundant, and back-up subsystem modes of operation, it was necessary to deviate from the flight sequence. Times for sequences were normally compressed from mission times. By May 23, 1974, a complete functional orbiter system, except propulsion, had gone through dynamics testing and was ready for another system test before space simulation testing.

While the PTO was undergoing system and environmental testing, the VO-2 bus arrived at the SAF. Inspection and assembly of VO-2 continued through June and mid-July of 1974. Meanwhile, the PTO was moved to the space simulator for controlled temperature and vacuum testing, supported by both orbiter test teams during around-the-clock operation. One half of the space simulation involved a system test with relatively complete cabling and detailed examination of orbiter performance. The other half involved limited cabling and concentrated on temperature control design verification.

During August 1974 all three orbiters were at the SAF. The PTO was undergoing lander compatibility and special testing. The VO-2 subsystems were being verified and integrated. The VO-3 bus had arrived and was being assembled. Normal operations on two orbiters were run simultaneously with the two test teams operating independently, while mechanics worked on the third orbiter. Initial integration testing on VO-3 started in September 1974.

In September 1974 the Orbiter Office was directed to develop cost reduction options. The success of the PTO test program and the quality of the hardware made it feasible to consider the PTO for flight. This eliminated system testing of VO-3 and permitted the reduction of test teams from 2 to 1. These reductions allowed electrical tests to be carried out on one orbiter system by a

single electrical test team while mechanical work was going on the second system in parallel. Consequently, VO-2 became the second flight unit and VO-3 subsystems became spares. Additional reductions in VO-2 testing were also made, including one less system test, no vibration, acoustics, or pyro shock, and reduced space simulation test time.

The effects of handling and testing of the VO-1 up to Sept. 9, 1974 were examined by disassembly, inspection and cleaning. VO-2 one-phase space simulation was completed and disassembly occurred shortly after VO-1 re-assembly. VO-1 was given a pre-shipment system test and turned over to the mechanical crew for shipping preparation. VO-2 was reassembled after post-environmental inspection and given a final pre-shipment system test. VO-2 shipment to AFETR occurred within two weeks after VO-1 shipment.

The VO-3 bus was sent to AFETR before VO-1 and VO-2 shipment in order to proof-test all shipping equipment. The VO-3 subsystems were used as spares to support system test activities at AFETR. During launch operations, an opportunity occurred to finish assembly and integration of VO-3, and this was almost all completed by the test team in spare time. After launch operations were concluded, VO-3 was returned to JPL and put into operation as a test bed for activities with the two orbiters in flight. New command sequences were checked and verified on VO-3 before uplink transmission. Anomalies occurring during flight were duplicated and resolved on VO-3.

SECTION II
TEST PLAN

A. OBJECTIVE

1. Test Program

The system test program for the Viking Orbiter was performed in accordance with JPL Document 612-22, the Test and Operations Plan. The orbiter system test program at JPL provided an orderly sequence of tests and operations leading to the type approval (TA) of the PTO and flight acceptance (FA) of the flight orbiter systems and spare assemblies. A phase of interface testing of the orbiter/lander, the orbiter/lander/Mission Operations System, and the orbiter/lander/Deep Space Network was conducted. Secondary operations included procedure development and personnel training.

2. System Test

The formal system test, as the most important element of the orbiter test program, demonstrated the orbiter performance as an integrated system. Within the limits of the test configuration and the earth-based environment, the system test provided a comprehensive and detailed exercise and evaluation of all parameters and functions of the Viking orbiters.

The system test provided the following functions:

(1) Exposed unexpected subsystem interaction and anomalies.
(2) Exercised all major elements of the system and demonstrated their ability to meet the applicable design requirements in the system environment.
(3) Provided a system performance history.
(4) Verified system performance in mission modes.

In addition, the system test provided the following secondary functions:

(1) Verified system compatibility with other mission systems.
(2) Demonstrated system functional margin for internal noise environment.
(3) Helped to develop mission support data processing.

The system test on the PTO provided the following benefits:

(1) Trained personnel for system operations.
(2) Source of system-qualified spares to support flight orbiters.
(3) System for verification of design margins and troubleshooting of flight system problems.

3. Redundancy

All system-level tests included both parts of block and functionally redundant elements. Tests with the PTO included both TA elements and spare elements in the block-redundant subsystems (Computer Command Subsystem (CCS), Data Storage Subsystem (DSS), Visual Image Subsystem (VIS), Attitude Control Electronics/Inertial Reference Unit (ACE/IRU), and Modulation Demodulation Subsystem (MDS)). The mixture of spares and TA hardware provided for a complete orbiter system for design verification and also for flight acceptance of the spare subsystems by operation in the system. When the spare subsystems were delivered, they were substituted for the TA subsystems to obtain the maximum system operating time on the spare hardware.

B. IMPLEMENTATION

1. Program Organization

The VO75 system test program was conducted under the supervision of the Test and Operations Manager, who was responsible to the Orbiter Spacecraft Manager for the following activities:

(1) Planning
(2) Implementation
(3) Management
(4) Liaison
(5) Critiques
(6) Security and Safety

Figure 2 shows the test program organization. The systems engineer was responsible for the design of the orbiter system, and the system design

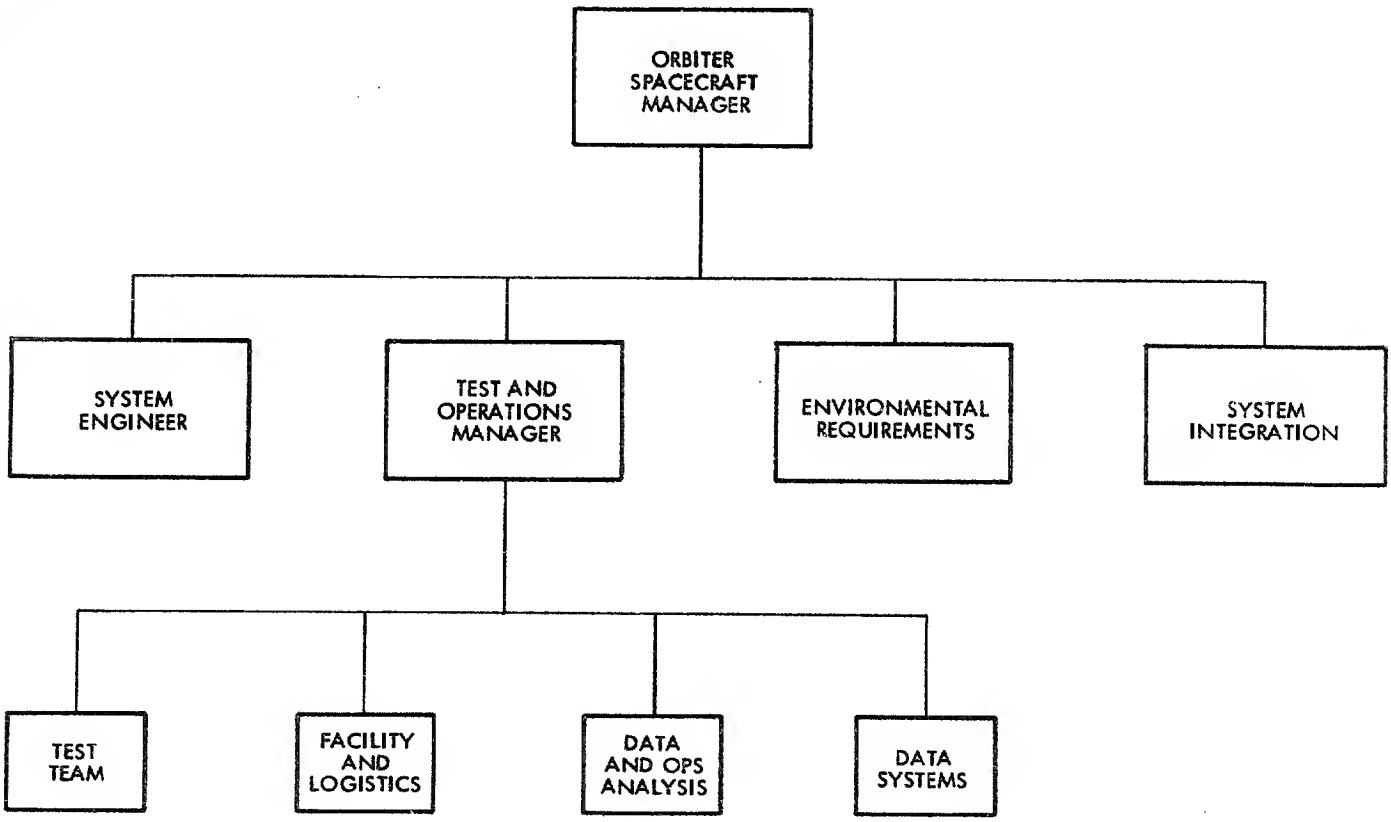


Figure 2. System Test Program Organization

group implemented the responsibility. The environmental requirements group developed requirements and supported testing such as vibration, shock, acoustics, thermal vacuum, and electromagnetic compatibility. The test team performed the system test operations which are of primary concern to this report.

2. Test Team

The orbiter test team (see Figure 3) was managed by a Test Chief who directed the activities of technical representatives, subsystem operators, and analysts in the conduct of all testing and operations. There was a representative for each of the six disciplines:

(1) Telecommunications
- Radio Frequency Subsystem (RFS)
- Modulation Demodulation Subsystem (MDS)
- Relay Telemetry Subsystem (RTS)
- X-Band Transmitter Subsystem (XTX)
- Relay Radio Subsystem (RRS)

(2) Astrionics
- Computer Command Subsystem (CCS)
- Flight Data Subsystem (FDS)
- Data Storage Subsystem (DSS)

(3) Guidance and Control
- Power Subsystem (PWR)
- Attitude Control Subsystem (ACS)
- Articulation Control Subsystem (ARTC)
- Pyrotechnic Subsystem (PYRO)
- Propulsion Subsystem, electrical (PROP)

(4) Science
- Visual Imaging Subsystem (VIS)
- Infrared Thermal Mapper Subsystem (IRTM)
- Mars Atmospheric Water Detector Subsystem (MAWD)

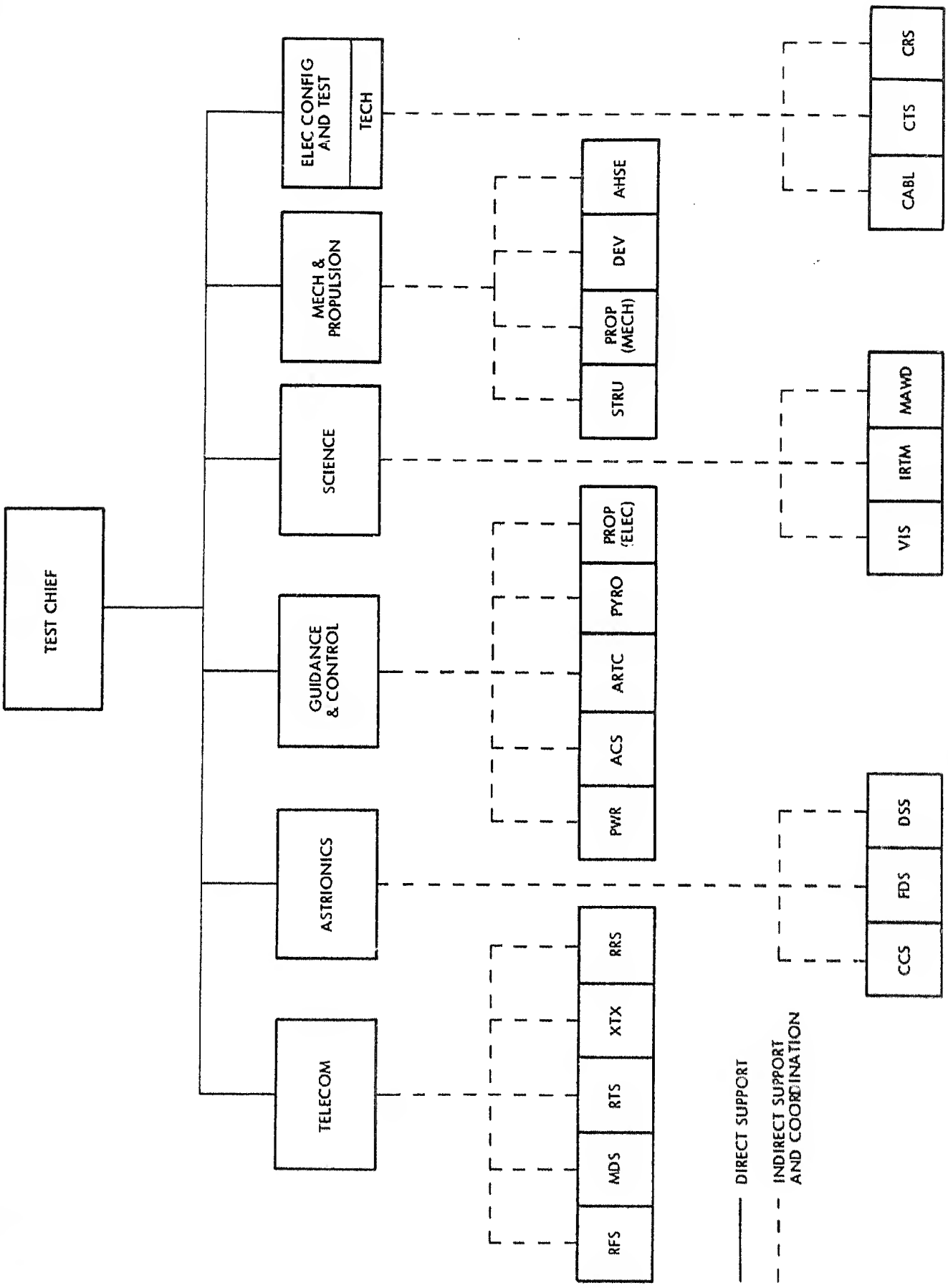


Figure 3. Test Team Functional Organization

(5) Mechanics and Propulsion (Mechanical Engineer)
- Structure Subsystem (STRU)
- Propulsion Subsystem, mechanical (PROP)
- Mechanical Devices Subsystem (DEV)
- Assembly, Handling, and Shipping Equipment (AHSE)

(6) Electrical Configuration and Test (Test Engineer)
- Cabling Subsystem (CABL)
- Central Timing Subsystem (CTS)
- Central Recorder Subsystem (CRS)

The representatives were responsible to the Test Chief for all aspects of performance and functional verification within their disciplines. The Mechanical Engineer was also responsible for the mechanical configuration and assembly of the system and for contamination control. The Test Engineer was responsible for the electrical configuration and setup of the system.

3. System Test Complex

System testing and data analysis were performed by a standard array of subsystem and system test equipment called the System Test Complex (STC). The subsystem test equipment elements of the STC were capable of providing failure isolation to the replaceable spares level through a combination of processed telemetry, direct and umbilical access, and data from other support equipment. Figure 4 shows the STC and interface for system test setup. Layout of the STC was per JPL Drawing 10058974 and the cabling per JPL Drawing 10050600.

4. Mission and Test Computer

The Mission and Test Computer (MTC) provided computer processing to handle and record the large mass of data produced by system testing. In real time, the MTC presented a system overview, sifting all data to expose unpredictable anomalies or malfunctions and providing the means of correlating seemingly unrelated events. In nonreal time, recorded data was reprocessed in other ways as requested.

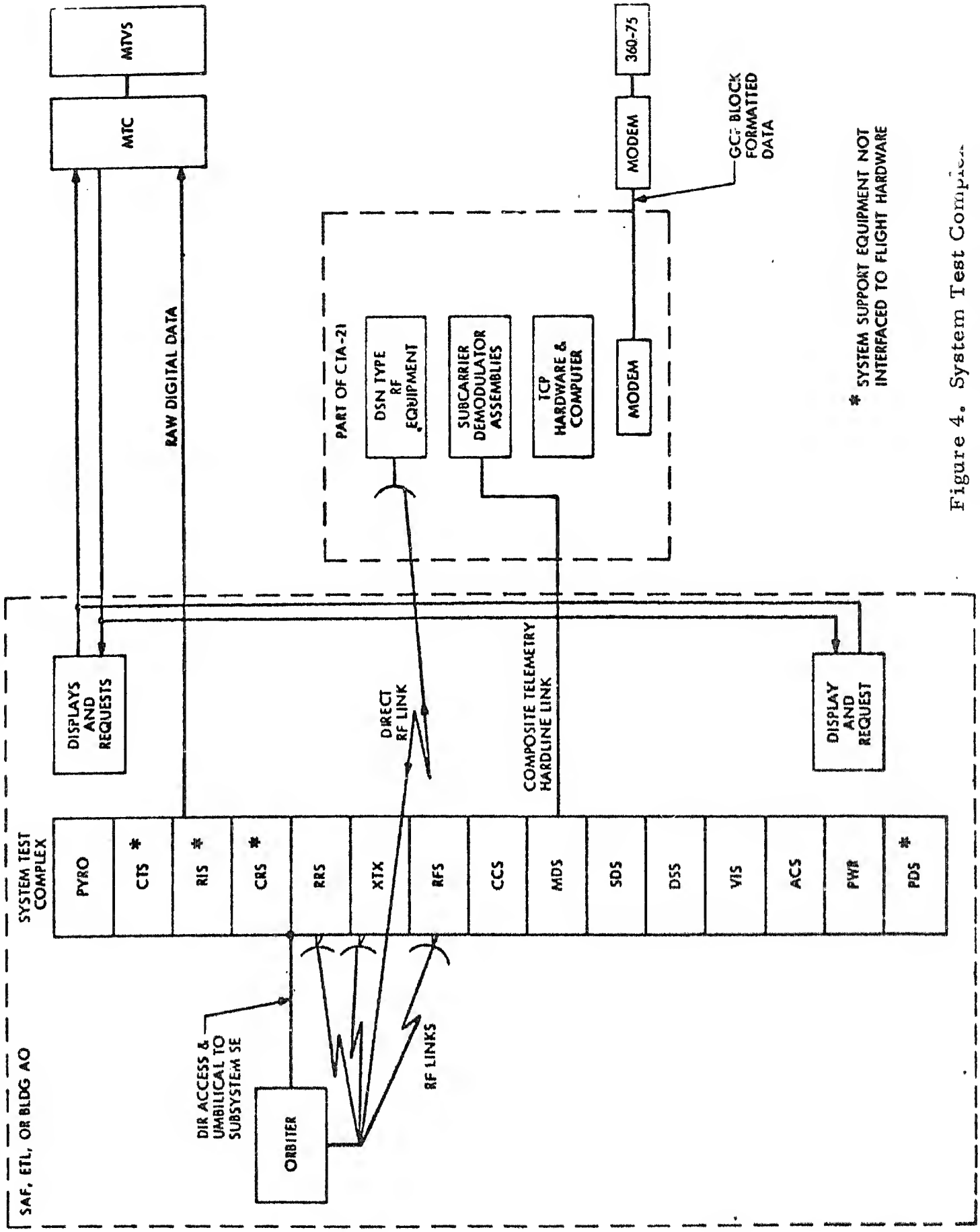


Figure 4. System Test Comple

5. Facilities

System testing at JPL took place at the following locations:

(1)	Spacecraft Assembly Facility (SAF)	Building 179
(2)	Environment Test Laboratory (ETL)	Building 144
(3)	25-Foot Space Simulator	Building 150

Test facilities within SAF are outlined in JPL Document VO75-4-1270, and are shown in detail on JPL Drawing 10058972.

6. Design and Operations Philosophy

The orbiter test equipment system design was based on use of required subsystem test equipment capabilities rather than construction of new system test equipment. Test capabilities were developed as computer aided, manpower intensive, manually controlled operations. No automation of system test procedures was used. No major software effort was required to support the test program other than the telemetry processing and CCS command generation software which carried over to the flight operations.

Skilled manpower permitted quick adjustment of tests to troubleshoot, define, and then work around anomalies without significant delays. Meticulous record keeping permitted a recovery of bypassed test elements without excessive recycling of tests already completed. Test team manpower maintained continuous communications with the cognizant divisions, facilitating quick response when problems required expert support.

7. Critiques

At the end of each test phase on each system, such as a system test or space simulation test, a critique was held by the operations manager. The test chief, his team, and a representative of each technical discipline were required to sum up the test results and report to the group. A board consisting of the Langley Research Center test manager, the Orbiter system engineer, and the Operations Manager, reviewed the results and recommendations, and concurred

in action required to continue into the next phase. Critiques served as management milestones between major reviews.

C. SCHEDULE

The system test program operations on the flight subsystems are shown in Figures 5 and 6. Figure 7 is the PTO subsystem history on the work experience accomplished between January, 1974 and September, 1975.

D. CONTAMINATION CONTROL

Contamination control during tests and operations performed on the Viking Orbiters at JPL conformed to the requirements of JPL Document 612-22. The controls were implemented per JPL Procedure VO75 501.

Building 179 made use of the vertical laminar flow tents from Mariner Mars 1971 as an airlock and precleaning area in the high bay. Most shipping and receiving was done through the airlock, in preference to the large sliding doors. During periods when the large sliding doors were opened, the orbiters were protected with non-static protective covers. The entire high-bay area of Building 179 was a Class 100,000 clean room.

Building 144 was controlled to minimize particulate contamination during testing operations. During inactive periods, protective covering was used to shield the orbiter.

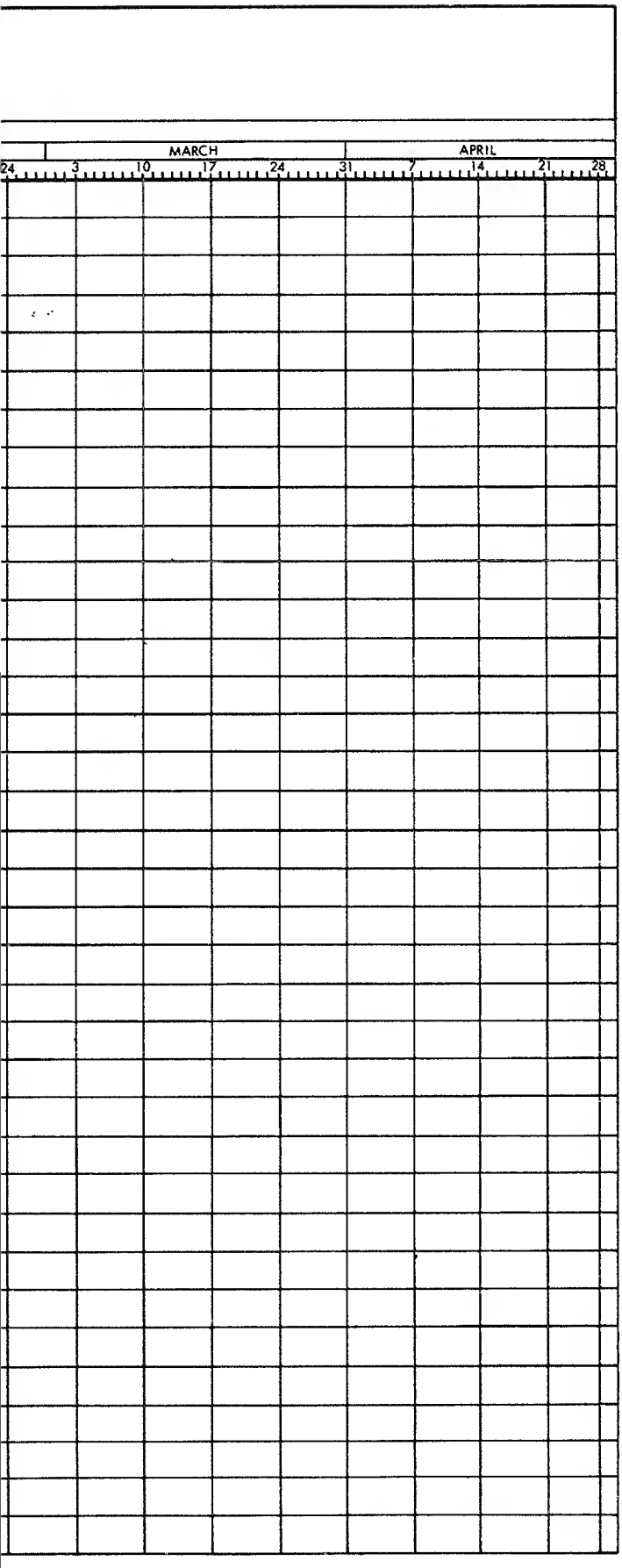
Building 150 had a newly completed clean assembly room opposite the test chamber. Control of the open chamber used a high-efficiency particulate air filter, an antistatic plastic curtain in front of the door opening, and a laminar flow tent attached to the curtain.

All hardware or exterior portion of shipping containers were cleaned in the airlock of Building 179 before entering the assembly area. All items, once in in the clean room, were cleaned again in a laminar flow clean room. All stored hardware was covered with precleaned antistatic plastic or placed in a precleaned container and stored in QA bonded stores.

E. CHANGE AND CONFIGURATION CONTROL

In discussions of Problem/Failure Reports (P/FRs) and corrective action (see Sections III, IV, and V), the impression may be given that fixes were incorporated on the spot. The actual procedure involved a formal problem resolution, processed and documented by the QA organization assigned to the SAF. Design changes by means of the Engineering Change Request (ECR) required concurrence by subsystem cognizant design engineers and system design engineers, with final approval by the Orbiter Spacecraft Manager. At the earliest opportunity, sometimes overnight, the defective hardware was removed from the system, transferred to subsystem cognizance, reworked and reverified in the subsystem laboratory under full QA cognizance, and returned, reinspected, and reinstalled for system verification.

TESTS AND OPERATIONS		* BUILD-UP AND SUBSYSTEM INTEGRATION (a)	* SYSTEM TEST (a)	PREP & SHIP TO AFETR (b)
SYSTEM OPERATION TIME, h	1321.8 (PTO)	(VO-1) 1407.2	1501.6	1501.6
SUBSYSTEM	1974 NOVEMBER 4 11 18 25	DECEMBER 2 9 16 23 30	1975 JANUARY 6 13 20 27	FEB 3 10
1. RADIO FREQUENCY SUBSYSTEM BAY I (2002 CU2, RA1, 2)		204 (SPARE)	202	
2. RADIO FREQUENCY SUBSYSTEM BAY XVI (2002 TW1, FH1, MX1, CU1, OF1, RE1, SW1, SW2, DX1)		204 (SPARE)	202	
3. MODULATE-DEMODULATE SUBSYSTEM (2003 A1, 2, 3, 4)		C104		
4. MODULATE-DEMODULATE SUBSYSTEM (2003 A5, 6, 7, 8)		C103		
5. BATTERY (2) (2004 EA9, EA13)		005		
6. POWER BAY X (MAIN- 2004A6, 8, 12, 20) (STANDBY- 2004Ax, x, 13, x)		002	006 4/	
7. POWER BAY XII (MAIN- 2004A9, 11, 15, 16, 18) (STANDBY- 2004A10, x, x, 17, 19)		004 1/		
8. SOLAR PANELS (2004 SP1, 5, 9, 13)	NOTE: SOLAR PANEL USE CONFORMS TO PLAN			
9. COMPUTER COMMAND SUBSYSTEM (2005 OU1, P1, M1, PS1)		003	001 (VO-2)	004 (VO-1)
10. COMPUTER COMMAND SUBSYSTEM (2005 OU2, P2, M2, PS2)		004 (VO-2)	002	
11. FLIGHT DATA SUBSYSTEM (2006A1-A8)		001 2/ 3/		
12. ATTITUDE CONTROL ELECTRONICS (2007 A1)		006		
13. ATTITUDE CONTROL ELECTRONICS (2007 A4)		003		
14. ACS INERTIAL REFERENCE UNIT (2007 A2, A3)		003		
15. ACS INERTIAL REFERENCE UNIT (2007 A5, A6)		007		
16. ACS REACTION CONTROL ASSEMBLY (2007, HP3, HP11)		006/007		003/005
17. ACS REACTION CONTROL ASSEMBLY (2007, LP1, LP5, LP9, LP13)		006/007		
18. CANOPUS TRACKER (2007 CT11)		102		
19. SUN SENSORS (2007 SC5; SA1, 5, 9, 13; SG5)		103		
20. PYRO ELECTRONICS SUBSYSTEM (2008 A1, A2)		101		
21. PROPULSION SUBSYSTEM (INCL GIMBAL ACTS) (2010 A10, A20, A50, A60, A90, A70, A80)	NOTE: PROPULSION USE CONFORMS TO PLAN	007 (SPARE)		
22. PYRO ARMING SWITCH (2) (2012 SW1, 2)		101/107		
23. ARTICULATION CONTROL ELECTRONICS (2015 A1)		005		
24. ARTICULATION CONTROL ACTUATORS (2015 BA1, 2, 3; SE4, 6, 12, 14; LA1)		103		
25. DATA STORAGE SUBSYSTEM BAY IV (2016 A1-A7)		006	5	
26. DATA STORAGE SUBSYSTEM BAY XIV (2016 A11-A17)		007 (VO-2)	5	004 (VO-1)
27. HIGH GAIN ANTENNA (2017 HG1, HG2, RJ1, RJ2)	NOTE: ANTENNA USE CONFORMS TO PLAN			
28. LOW GAIN ANTENNA (2017 LG1, 2, 3)	NOTE: ANTENNA USE CONFORMS TO PLAN			
29. VISUAL IMAGING SUBSYSTEM (2036 A1, A3)		007		
30. VISUAL IMAGING SUBSYSTEM (2036 A2, A4)		004		
31. INFRARED THERMAL MAPPER SUBSYSTEM (2038 TM1)		003		
32. MARS ATMOSPHERIC WATER DETECTOR SUBSYSTEM (2039 HA1, A2, 3, 4)		108		
33. X-BAND TRANSMITTER SUBSYSTEM (2042 A1)		4		
34. RELAY RADIO SUBSYSTEM (2052 RF1, FD1, PT1)		204 (SPARE)		
35. RELAY TELEMETRY SUBSYSTEM (2056 A1-A4)		C102		
36. RELAY ANTENNA SUBSYSTEM (2067 RA1)	NOTE: ANTENNA USE CONFORMS TO PLAN			



LEGEND:

XXXX — ASSEMBLY SERIAL NUMBER FLIGHT SUBSYSTEM INSTALLED

PTO SUBSYSTEM INSTALLED

REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM

P/FR, REMOVAL OF SUBSYSTEM FOR

ECR, REMOVAL OF SUBSYSTEM FOR

SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/OR CALIBRATION

SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/FR SUMMARY

	FLT	OSE
(a) - 34457 THRU 34495 WERE WRITTEN DURING BUILD-UP AND SYSTEM TEST	24	15
(b) - 34496, 34497 & 34498 WRITTEN THRU 2-7-75	2	1

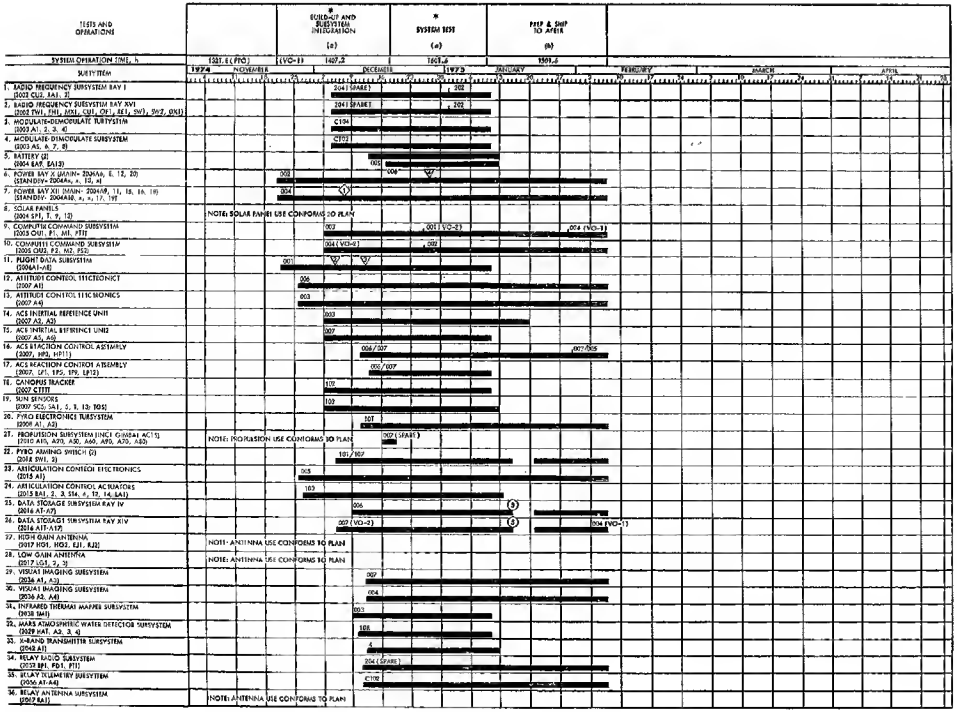
* CCS SOFTWARE PROGRAM REVISION "E"

SUMMARY OF REMOVALS:

12-6-74	◇1	4A11 S/N 004, HGA HEATER FUSES OPEN, P/FR 34462. RE-INSTALLED 12-16-74 (S/N 002 INSTALLED DURING REPAIR). R/RC 170682
12-5-74	▽2	6A3 S/N A102 FOR ECR 18091, CHANGE PHASE OF 32 kHz CLOCK. RE-INSTALLED 12-9-74. R/RC 170680
12-11-74	▽3	6A4 AND 6A7 S/N A102 FOR ECR 18100, MEMORY LOAD ERROR MOD. RE-INSTALLED 12-11-74. R/RC 170683. BOTH UNITS REMOVED AGAIN ON 12-12-74 TO CORRECT WIRING ERROR MADE DURING ECR MOD. RE-INSTALLED 12-12-74. R/RC 16255
12-27-74	▽4	4A20 S/N 004 FOR ECR 18070, INCREASE CONVERTER LOAD CAPACITY. (4A20 S/N 005 INSTALLED DURING MOD). RE-INSTALLED 1-22-75. R/RC 16207
1-16-75	⑤	DSS S/N 006 & 007 REMOVED FOR CALIBRATION AND REDUNDANT ELEMENT VERIFICATION. RE-INSTALLED 1-21-75. R/RC 170579 & 170580.

NOTE:
CERTAIN HARDWARE, SUCH AS SUN SENSORS, L.P. GAS SYSTEMS AND ACTUATORS ARE SUBJECT TO RELATIVELY FREQUENT REMOVAL & RE-INSTALLATION (R&R), THIS DOCUMENT DOES NOT RECORD SUCH R&Rs. DETAILS ARE DOCUMENTED IN SAF LOG BOOKS

Figure 5.
VO-1 Subsystem History



LEGEND:

- XXXX — ASSEMBLY SERIAL NUMBER FLIGHT SUBSYSTEM INSTALLED
- PTO SUBSYSTEM INSTALLED
- REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM
- E/R, REMOVAL OF SUBSYSTEM FOR
- ECR, REMOVAL OF SUBSYSTEM FOR
- SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/OR CALIBRATION
- SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/R SUMMARY

		PLT	OSE
(a)	36407 THRU 36495 WERE WRITTEN DURING BUILD-UP AND SYSTEM TEST	24	15
(b)	36470, 36497 & 36498 WRITTEN THRU 2-7-75	2	1

* OCS SOFTWARE PROGRAM REVISION "E"

SUMMARY OF REMOVALS:

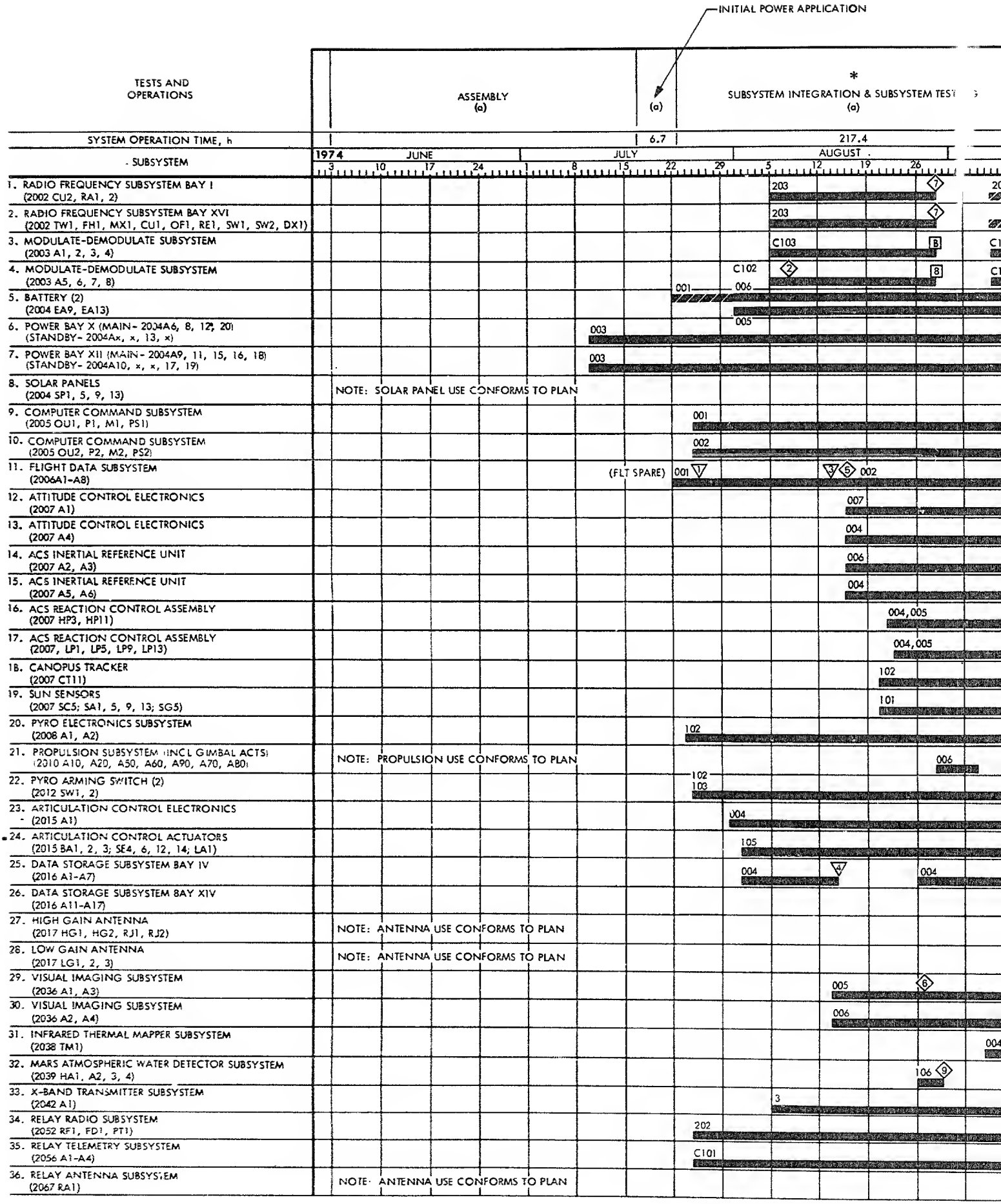
- 12-6-74 — 6475 S/N 004, HGA GEARUP FAILED (P/N: P/R 36402). RE-INSTALLED 12-12-74 S/N 002 INSTALLED DURING REPAIR). R/RC 170682
- 12-5-74 — 6403 S/N A102 FOR ECR 18091, CHANGE PHASE OF 32 kHz CLOCK. RE-INSTALLED 12-19-74. R/RC 170681
- 12-17-74 — 6AA AND 6AF S/N A102 FOR ECR 19100, MEMORY LOAD ERROR MOD. RI-INSTALLED 12-11-74. R/RC 170683. BOTH UNITS REMOVED AGAIN ON 12-19-74 TO CORRECT WIRING ERROR MADE DURING ECR MOD.. RE-INSTALLED 12-12-74. R/RC 16623
- 12-27-74 — 6420 S/N 006 FOR ECR 19090, INCREASE CONVERTER LOAD CAPACITY. 6 6420 S/N 005 INSTALLED DURING MOD.). RI-INSTALLED 1-28-75. R/RC 16207
- 1-16-75 — 056 S/N 004 & 007 REMOVED FOR CALIBRATION AND REDUNDANT ELEMENT VERIFICATION. RE-INSTALLED 1-21-75 R/RC 170599 & 170680.

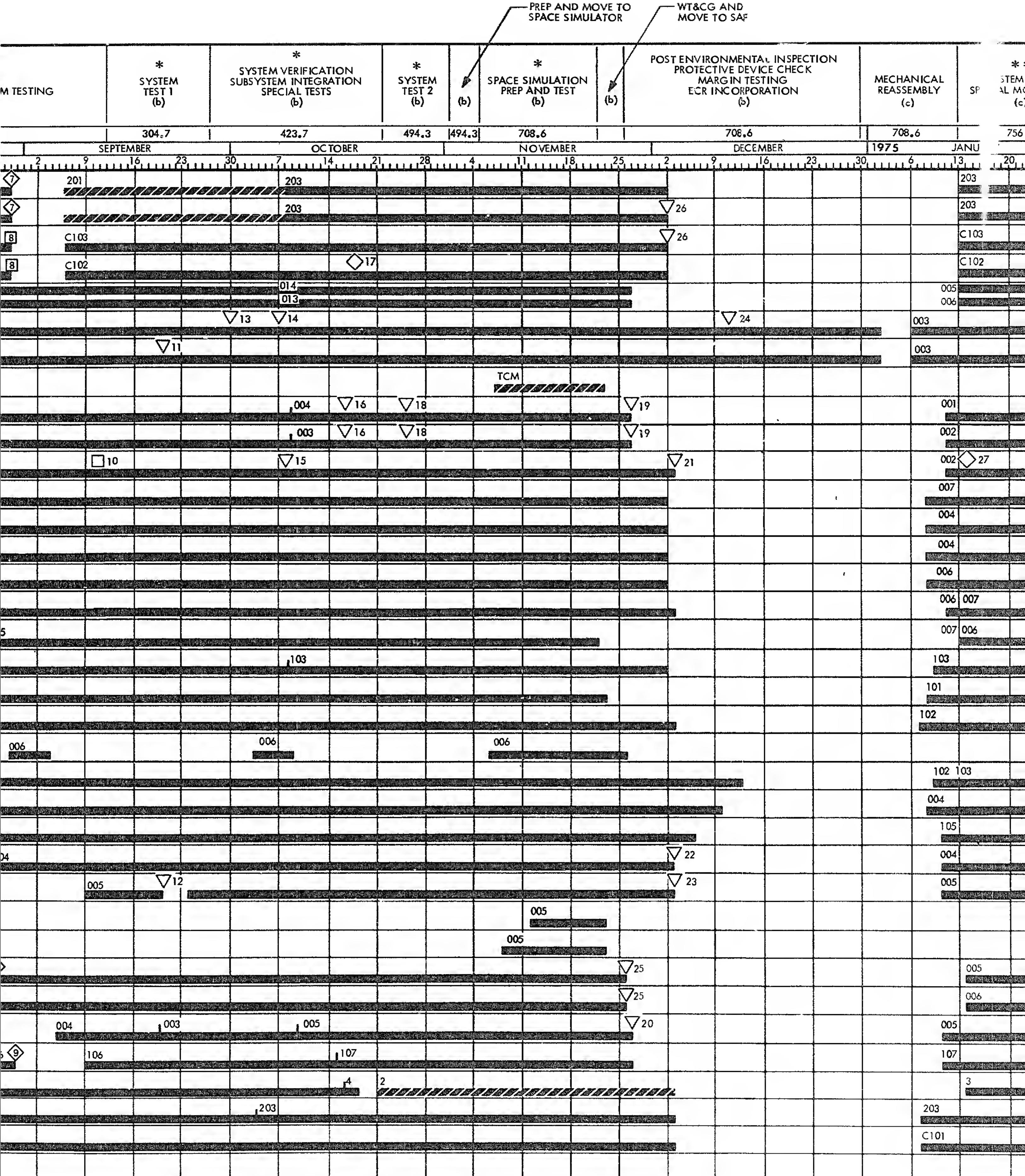
NOTE:

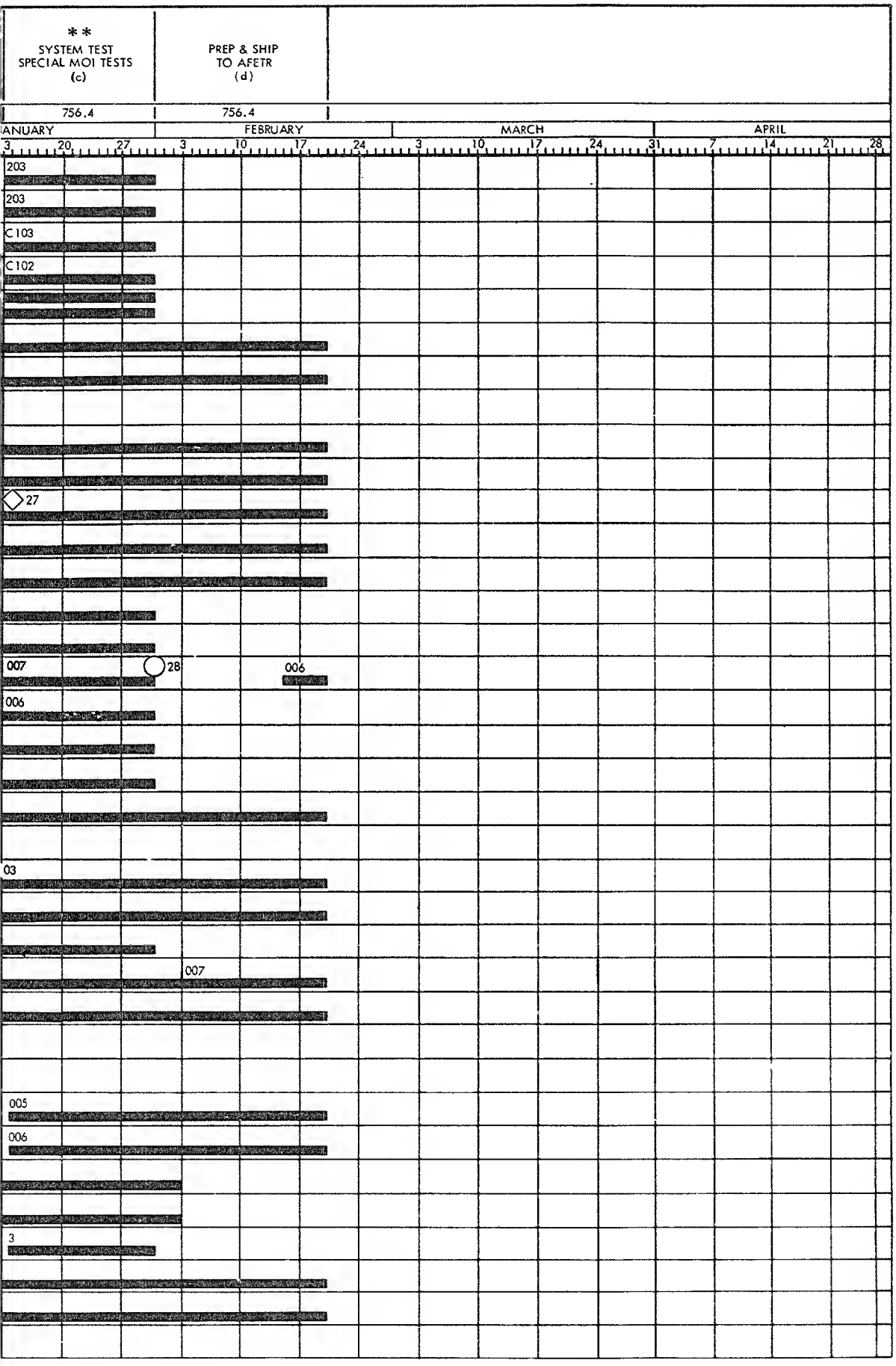
CERTAIN HARDWARE, SUCH AS SUN SENSORS, E.P. GAS SYSTEMS AND ACTUATORS ARE SUBJECT TO REASONS IV (2) (QUIET) REMOVAL & RE-INSTALLATION (QUIET). THIS DOCUMENT DOES NOT RECORD SUCH R&R. DETAILS ARE DOCUMENTED IN SAF LOG BOOKS

Figure 5.
VO-1 Subsystem History

2-11/2-12


INITIAL POWER APPLICATION
TESTS AND OPERATIONS
ASSEMBLY (a)
(a)
* SUBSYSTEM INTEGRATION & SUBSYSTEM TEST (a)
SYSTEM OPERATION TIME, h
6.7
217.4
SUBSYSTEM
1974
JUNE
JULY
AUGUST
3 10 17 24 1 8 15 22 29 5 12 19 26
1. RADIO FREQUENCY SUBSYSTEM BAY I (2002 CU2, RA1, 2)
2. RADIO FREQUENCY SUBSYSTEM BAY XVI (2002 TW1, FH1, MX1, CU1, OF1, RE1, SW1, SW2, DX1)
3. MODULATE-DEMODULATE SUBSYSTEM (2003 A1, 2, 3, 4)
4. MODULATE-DEMODULATE SUBSYSTEM (2003 A5, 6, 7, 8)
5. BATTERY (2) (2004 EA9, EA13)
6. POWER BAY X (MAIN- 2004A6, 8, 12, 20) (STANDBY- 2004Ax, x, 13, x)
7. POWER BAY XII (MAIN- 2004A9, 11, 15, 16, 18) (STANDBY- 2004A10, x, x, 17, 19)
8. SOLAR PANELS (2004 SP1, 5, 9, 13)
NOTE: SOLAR PANEL USE CONFORMS TO PLAN
9. COMPUTER COMMAND SUBSYSTEM (2005 OU1, P1, M1, PS1)
10. COMPUTER COMMAND SUBSYSTEM (2005 OU2, P2, M2, PS2)
11. FLIGHT DATA SUBSYSTEM (2006A1-A8)
(FLT SPARE)
12. ATTITUDE CONTROL ELECTRONICS (2007 A1)
13. ATTITUDE CONTROL ELECTRONICS (2007 A4)
14. ACS INERTIAL REFERENCE UNIT (2007 A2, A3)
15. ACS INERTIAL REFERENCE UNIT (2007 A5, A6)
16. ACS REACTION CONTROL ASSEMBLY (2007 HP3, HP11)
17. ACS REACTION CONTROL ASSEMBLY (2007, LP1, LP5, LP9, LP13)
18. CANOPUS TRACKER (2007 CT11)
19. SUN SENSORS (2007 SC5; SA1, 5, 9, 13; SG5)
20. PYRO ELECTRONICS SUBSYSTEM (2008 A1, A2)
21. PROPULSION SUBSYSTEM (INCL GIMBAL ACTS) (2010 A10, A20, A50, A60, A90, A70, A80)
NOTE: PROPULSION USE CONFORMS TO PLAN
22. PYRO ARMING SWITCH (2) (2012 SW1, 2)
23. ARTICULATION CONTROL ELECTRONICS (2015 A1)
24. ARTICULATION CONTROL ACTUATORS (2015 BA1, 2, 3; SE4, 6, 12, 14; LA1)
25. DATA STORAGE SUBSYSTEM BAY IV (2016 A1-A7)
26. DATA STORAGE SUBSYSTEM BAY XIV (2016 A11-A17)
27. HIGH GAIN ANTENNA (2017 HG1, HG2, RJ1, RJ2)
NOTE: ANTENNA USE CONFORMS TO PLAN
28. LOW GAIN ANTENNA (2017 LG1, 2, 3)
NOTE: ANTENNA USE CONFORMS TO PLAN
29. VISUAL IMAGING SUBSYSTEM (2036 A1, A3)
30. VISUAL IMAGING SUBSYSTEM (2036 A2, A4)
31. INFRARED THERMAL MAPPER SUBSYSTEM (2038 TM1)
32. MARS ATMOSPHERIC WATER DETECTOR SUBSYSTEM (2039 HA1, A2, 3, 4)
33. X-BAND TRANSMITTER SUBSYSTEM (2042 A1)
34. RELAY RADIO SUBSYSTEM (2052 RF1, FD1, PT1)
35. RELAY TELEMETRY SUBSYSTEM (2056 A1-A4)
36. RELAY ANTENNA SUBSYSTEM (2067 RA1)
NOTE: ANTENNA USE CONFORMS TO PLAN


PREP AND MOVE TO SPACE SIMULATOR
WT&CG AND MOVE TO SAF
M TESTING
* SYSTEM TEST 1 (b)
* SYSTEM VERIFICATION SUBSYSTEM INTEGRATION SPECIAL TESTS (b)
* SYSTEM TEST 2 (b)
(b)
* SPACE SIMULATION PREP AND TEST (b)
(b)
POST ENVIRONMENTAL INSPECTION PROTECTIVE DEVICE CHECK MARGIN TESTING ECR INCORPORATION (b)
MECHANICAL REASSEMBLY (c)
304.7
423.7
494.3
494.3
708.6
708.6
708.6
756
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
1975
JANU
TCM



LEGEND:

XXXX — ASSEMBLY SERIAL NUMBER FLIGHT SUBSYSTEM INSTALL

PTO SUBSYSTEM INSTALLED

REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTIO ACCESS TO OTHER SUBSYST

P/FR, REMOVAL OF SUBSYS FOR

ECR, REMOVAL OF SUBSYST FOR

SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/C CALIBRATION

SUBSYSTEM REMOVED FOR R OTHER THAN LISTED ABOVE

P/FR SUMMARY

(a) 34601 THRU 34677 WERE WRITTEN THRU SIS INTEGRATION & TEST

(b) 34678 THRU 34775 WERE WRITTEN THRU POST ENVIRONMENTAL INSPECTION

(c) 34776 THRU 34782 WERE WRITTEN THRU 1-20-75

(d) 34783 THRU 34295 WERE WRITTEN THRU 2-20-75

* CCS SOFTWARE PROGRAM REVISION

** CCS SOFTWARE PROGRAM REVISION FOR SYSTEM TEST, REVISION "F" FOR SPECIAL MOI TESTS

SUMMARY OF REMOVALS:

7-25-74 — FDS 6A3 MODULE CIRCUITRY PER EC

8-8-74 — MDS TMU 3A7 SN ACTIVE MODE IN TESTED AT DIFFE OCCUR. P/FR 34

8-13-74 — FDS SN001 (FLIG MODULE SNA103 OF 2.4 KHZ CLO

8-15-74 — DSS SN004 RETUR CIRCUIT WAS MO RE-INSTALLED 8-

8-16-74 — FDS 6A7 SNA103 CONTROL WORD REPLACED AN IC

8-27-74 — VIS 36A4 SN005 FROM CONNECT CLEANED, SCREV R/RC 16065.

8-29-74 — RFS BAY 1 SN203 VCO PROBLEM.

8-29-74 — MDS REMOVED A

8-30-74 — MAWD SN106 RE OUTPUTS. THE F P/FR 34651. RE-

SERIAL NUMBER
SYSTEM INSTALLED

TEM INSTALLED

F SUBSYSTEM
AGE, PROTECTION,
OTHER SUBSYSTEM

VAL OF SUBSYSTEM

VAL OF SUBSYSTEM

REMOVED FOR
ENT TEST AND/OR
ON

REMOVED FOR REASONS
N LISTED ABOVE

	S/C	OSE
RE WRITTEN ON & TEST	37	40
RE WRITTEN MENTAL	50	48
RE WRITTEN	5	2
RE WRITTEN	7	6

RAM REVISION "D"

RAM REVISION "E"
VISION "F" FOR

9-11-74	10	6A1 AND 6A7 S/N A102 REPLACED WITH VO-2 6A1 AND 6A7 S/N A103; 6A3 S/N A102 REPLACED WITH VO-2 6A3 S/N A103 ON 9-16-74.
9-20-74	11	4A16 S/N 008 RETURNED TO DIVISION FOR ECR 18016, LIMIT INVERTER FREE RUN FREQUENCY SHIFT TO 20 Hz. RE-INSTALLED 10-7-74. R/RC 170214.
9-20-74	12	DTR BAY 14 FOR ECR 18035, REDUCE VIS DATA NOISE IN DSS; AND ECR 18008, LIMIT WORST CASE LOAD CURRENT. RE-INSTALLED 9-24-74. R/RC 170218
9-30-74	13	4A8 S/N 003 FOR ECR 17975 CHANGE CONNECTOR WIRING TO ALLOW 3 WIRES TO CARRY LOAD. VO-2 4A8 S/N 005 INSTALLED. R/RC 170225.
10-7-74	14	4A17 S/N 005 FOR ECR 18016, LIMIT INVERTER FREE RUN FREQUENCY SHIFT TO 20 Hz. VO-2 4A17 S/N 007 INSTALLED. R/RC 16120.
10-8-74	15	6A4 AND 6A6 S/N A103 FOR ECR 18048, MODIFY TO PREVENT AMBIGUITY IN MAWD DATA. REPLACED 10-11-74 R/RC 16123. ON 10-21-74 BOTH UNITS AGAIN REMOVED FOR FURTHER MODS FOR ECR 18048. RE-INSTALLED 10-22-74 R/RC 16149. ALSO ON 10-22-74 THE 6A3 S/N A103 WAS REMOVED FOR ECR 18065, TO CORRECT ERROR IN ECR 18009. RE-INSTALLED 10-24-74 R/RC 170734.
10-16-74	16	5P1 S/N 004 AND 5P2 S/N 003 FOR ECR 18055, MODIFY CKT TO ALLOW MEMORY CLAMP ENOUGH TIME TO RELEASE PRIOR TO PROCESSOR RESPONSE, RE-INSTALLED 10-22-74 (S/N 001 AND 002 INSTALLED DURING MOD). R/RC 170650.
10-18-74	17	3A5 S/N C104 ANOMALY AT CCS CMD INTERFACE. P/FR 34727. RETURNED TO DIVISION FOR CHECK, BUT SAF PROBLEM COULD NOT BE REPRODUCED. 3A5 S/N C105 (VO-2 UNIT) INSTALLED. R/RC 16152.
10-25-74	18	50U1 S/N 003 AND 50U2 S/N 004 FOR ECR 18066, ADD ISOLATION DIODES TO EACH CC BUFFER DRIVER. RE-INSTALLED 10-30-74 (S/N 001 AND 002 INSTALLED DURING MOD). R/RC 16167.
11-27-74	19	CCS HARNESSES S/N 002 FOR ECR 18088, INSTALL CURRENT LIMITING RESISTORS IN 9W5 AND 9W55. R/RC 16258.
11-27-74	20	MAWD S/N 107 FOR ECR 18101, MODIFY TO ASSURE THAT CHOPPER WILL NOT START WHEN INSTRUMENT IS TURNED ON AT LOW FA TEMPERATURE LIMITS. R/RC 170674.
12-3-74	21	FDS S/N 002 FOR ECR 18091, CHANGE PHASE OF 30 kHz CLOCK AND ECR 18100, MEMORY LOAD ERROR MODIFICATION. R/RC 170681.
12-3-74	22	DSS S/N 004 FOR ECR 18050, INCREASE NOISE MARGIN; ALSO PROVIDE MORE ACCURATE TAPE POSITION INFORMATION. R/RC 16230.
12-3-74	23	DSS S/N 005 FOR ECR 18050, INCREASE NOISE MARGIN; ALSO, PROVIDE MORE ACCURATE TAPE POSITION INFORMATION. R/RC 16229.
12-11-74	24	4A20 S/N 003 FOR ECR 18070, INCREASE CONVERTER LOAD CAPACITY. R/RC 16222.
11-26-74	25	VIS S/N 005 AND 006 FOR ECRs 17909, 17910, 18001, 18071, 18072; ECIs 84016, AND 84059. RETESTED AS REQUIRED AFTER MODS. RE-INSTALLED 1-14-75. R/RC 170406.
12-2-74	26	MDS S/N C102 AND C103 FOR ECR 18064, ELIMINATE HF OSC ON COMPOSITE TELEMETRY SIGNAL. RE-INSTALLED 1-14-75. R/RC 170677.
1-14-75	27	FDS 6A1 (POWER SUPPLY) S/N A103 AND 6A8 (MEMORY) S/N A102 FOR P/FR 34776: ON POWER TURN ON AFTER RE-ASSEMBLY MEMORY A AND B CAME IN "POWER FAIL" CONDITION. 6A1 S/N A104 AND 6A8 S/N A101 INSTALLED 1-17-75. RE-INSTALLED 2-10-75. R/RC 170699
2-1-75	28	RCA HIGH PRESSURE MODULES S/N 006 & 007 REMOVED FOR FUNCTIONAL AND LEAK CHECKS. S/N 006 RE-INSTALLED 2-15-75. S/N 007 SHIPPED SEPERATELY AND INSTALLED AT ETR ON 2-26-75.

DS 6A3 MODULE SNA102 RETURNED TO DIVISION TO ADD NOISE SUPPRESSION CIRCUITRY PER ECR 17937. RE-INSTALLED 7-29-74. R/RC 16388.

MDS TMU 3A7 SNC102 AND 3A8 SNC102 RETURNED TO DIVISION TO CHECK FOR ACTIVE MODE INDICATION MARGINAL AND FALSE TELEMETRY INDICATIONS. UNITS TESTED AT DIFFERENT TEMPERATURES FOR 13.4 HOURS BUT PROBLEMS DID NOT OCCUR. P/FR 34629 AND 34630. RE-INSTALLED 8-15-74. R/RC 170486.

DS SN001 (FLIGHT SPARE) REMOVED, SN002 (VO-2 UNIT) INSTALLED, ALSO 6A3 MODULE SNA103 RETURNED TO DIVISION FOR CIRCUIT MODIFICATION TO CORRECT PHASE OF 2.4 KHZ CLOCK PER ECR 17995. RE-INSTALLED 8-15-74. R/RC 170500.

SS SN004 RETURNED TO DIVISION TO INCORPORATE TAPE INCREMENT COUNTER FIX. CIRCUIT WAS MODIFIED TO ELIMINATE ANY UNWANTED TACH PULSES PER ECR 17958. E-INSTALLED 8-26-74. R/RC 16395.

DS 6A7 SNA103 RETURNED TO DIVISION TO CHECK FOR IMPROPER DATA FOR VIS B CONTROL WORD AND INCORRECT RESPONSE TO COMMAND PER P/FR 34634 AND 34635. EPLACED AN IC 54L95 IN THE 6A7A2. RE-INSTALLED 9-3-74. R/RC 16056.

IS 36A4 SN005 RETURNED TO DIVISION TO CHECK FOR LACK OF CONTINUITY ROM CONNECTOR TO GROUND. FOUND GROUND LUG SCREW NOT TIGHTENED. AREA WAS LEANED, SCREW PROPERLY TORQUED AND AREA RE-COATED. RE-INSTALLED 8-29-74. /RC 16065.

FS BAY 1 SN203 AND BAY 16 SN203 RETURNED TO VENDOR FOR INVESTIGATION OF CO PROBLEM. PTO UNIT INSTALLED SO SAF TESTS COULD CONTINUE.

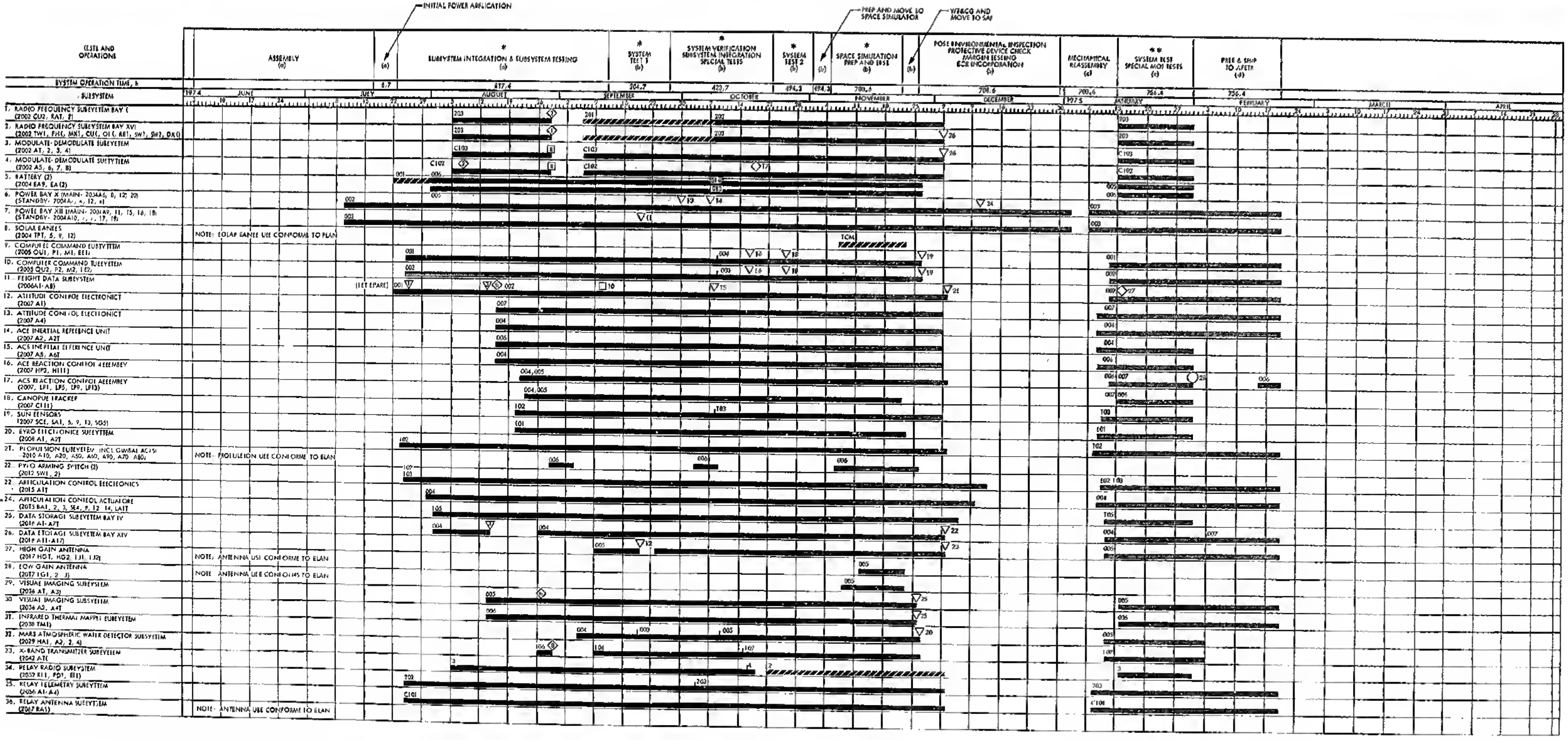
MDS REMOVED AND RE-INSTALLED WITH RFS. (MDS SHARES BAY 1 WITH RFS).

MAWD SN106 RETURNED TO DIVISION TO CHECK EXCESSIVE VARIATION IN DETECTOR OUTPUTS. THE PHASE-SHIFTER WAS RE-CALIBRATED AND UNIT RETURNED TO SAF. /FR 34651. RE-INSTALLED 9-9-74. R/RC 16073.

NOTE

CERTAIN HARDWARE, SUCH AS SUN SENSORS, L.P. GAS SYSTEMS AND ACTUATORS ARE SUBJECT TO RELATIVELY FREQUENT REMOVAL & RE-INSTALLATION (R&R), THIS DOCUMENT DOES NOT RECORD SUCH R&Rs. DETAILS ARE DOCUMENTED IN SAF LOG BOOKS.

Figure 6.
VO-2 Subsystem History



LEGEND:

- XXXX — ASSEMBLY SERIAL NUMBER, FLIGHT SUBSYSTEM INSTALLED
- STC SUBSYSTEM INSTALLED
- REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM
- PFR, REMOVAL OF SUBSYSTEM FOR
- ECR, REMOVAL OF SUBSYSTEM FOR
- SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/OR CALIBRATION
- SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/FR SUMMARY

		E/C	OSE
(a)	34401 THRU 34677 WERE WRITTEN THRU SYS INTEGRATION & TEST	37	40
(b)	34678 THRU 34775 WERE WRITTEN THRU POST ENVIRONMENTAL INSPECTION	50	48
(c)	34776 THRU 34782 WERE WRITTEN THRU 2-29-75	1	2
(d)	34783 THRU 34795 WERE WRITTEN THRU 2-20-75	7	6

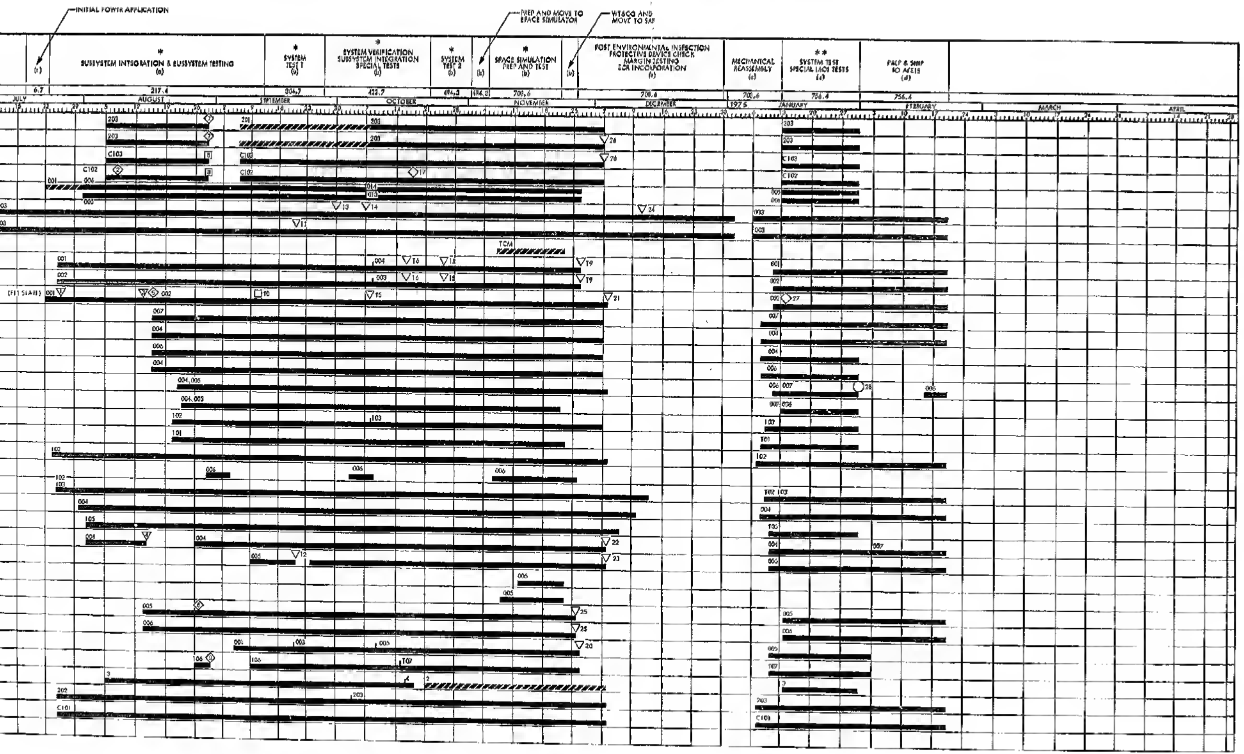
* CCE SOFTWARE PROGRAM REVISION D

** CCE SOFTWARE PROGRAM REVISION E FOR SYSTEM TEST, REVISION F FOR SPECIAL MOT TESTS

SUMMARY OF REMOVALS

Date	Symbol	Description
7-25-74	1	FDS 6A3 MODULE SN A102 RETURNED TO DIVISION TO ADD NOISE SUPPRESSION CIRCUITRY PER ECR 17927. RE-INSTALLED 7-29-74. I/RC 16388
8-7-74	2	MDE TMU 3A7 SN C102 AND 3A8 SN C102 RETURNED TO DIVISION TO CHECK FOR ACTIVE MODE INDICATION MARGINAL AND FALSE TELEMETRY INDICATIONS. UNITS TESTED AT DIFFERENT TEMPERATURES FOR 13.4 HOURS BUT PROBLEMS DID NOT OCCUR. P/FR 34629 AND 34630. RE-INSTALLED 8-15-74. I/RC 17046
8-13-74	3	FDS S/N 001 (FLIGHT SPARE) REMOVED. S/N 002 (VO 2 UNIT) INSTALLED. ALSO 6A3 MODULE SN A103 RETURNED TO DIVISION FOR CIRCUIT MODIFICATION TO CORRECT PHASE OF 2.4 KHZ CLOCK PER ECR 17915. RE-INSTALLED 8-15-74. I/RC 170500.
8-15-74	4	DSS ER004 RETURNED TO DIVISION TO INCORPORATE TAPE INCREMENT COUNTER FIX. CIRCUIT WAS MODIFIED TO ELIMINATE ANY UNWANTED TACH PULSES PER ECR 17958. RE-INSTALLED 8-26-74. I/RC 16472
8-16-74	5	FDS 6A7 SN A101 RETURNED TO DIVISION TO CHECK FOR IMPROPER DATA FOR VIS CONTROL WORD AND INCORRECT RESPONSE TO COMMAND PER P/FR 34634 AND 34635. REPLACED ALL IC SALTS IN THE 6A1A2. RE-INSTALLED 9-3-74. I/RC 16059.
8-27-74	6	IRS 36A4 SN 005 RETURNED TO DIVISION TO CHECK FOR LACK OF CONTINUITY FROM CONNECTOR TO GROUND. FOUND GROUND LUG SCREW NOT TIGHTENED. AREA WAS CLEANED, SCREW PROPERLY TORQUED AND AREA RE-COATED. RE-INSTALLED 8-29-74. I/RC 16063.
8-29-74	7	RFS BAY I SN 203 AND BAY 16 SN 203 RETURNED TO VENDOR FOR INVESTIGATION OF VCO PROBLEM. STC UNIT INSTALLED SO THAT TESTS COULD CONTINUE
8-31-74	8	MDE REMOVED AND RE-INSTALLED WITH RFS. (MDS SHARES BAY I WITH RFS).
8-30-74	9	MAWD ELEC RETURNED TO DIVISION TO CHECK EXCESSIVE VARIATION IN DETECTOR OUTPUTS. THE PHASE-SHIFTER WAS RE-CALIBRATED AND UNIT RETURNED TO TAF. P/FR 34651. RE-INSTALLED 9-9-74. I/RC 16072.

Date	Symbol	Description
9-11-74	10	6AC… S/N…
9-20-74	11	4A1… REC…
9-20-74	12	DTR… EIM…
9-30-74	13	4A8… TO A…
10-7-74	14	4A1… 20 H…
10-8-74	15	6A4… MAV… REM… R/RC… TO…
10-16-74	16	SPI… CLA… 10-2…
10-18-74	17	2A5… DIVI… S/N…
10-25-74	18	SOU… EACH… DIRE…
11-27-74	19	CCS… IN P…
11-27-74	20	MAW… STA… R/RC…
12-3-74	21	FDE… MEM…
12-3-74	22	DEE… ACC…
12-3-74	23	DSS… ACC…
12-11-74	24	4A20… R/RC…
11-26-74	25	VIS… BIAS…
12-2-74	26	MDS… INT…
1-14-75	27	FDS… ON… COM… RE-I…
2-1-75	28	ICA… CHEC… WEI…



LEGEND:

XXXX — ASSEMBLY SERIAL NUMBER, FLIGHT SUBSYSTEM INSTALLED

PTO SUBSYSTEM INSTALLED

REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM

P/FR, REMOVAL OF SUBSYSTEM FOR

ECR, REMOVAL OF SUBSYSTEM FOR

SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/OR CALIBRATION

SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/FR SUMMARY

		S/C	OST
(a)	34601 THRU 34677 WERE WRITTEN THRU S/S INTEGRATION & TEST	37	40
(b)	34678 THRU 34775 WERE WRITTEN THRU POST ENVIRONMENTAL INSPECTION	50	48
(c)	34776 THRU 34782 WERE WRITTEN THRU 1-20-75	5	2
(d)	34783 THRU 34795 WERE WRITTEN THRU 2-20-75	7	6

* CCS SOFTWARE PROGRAM REVISION "0"

** CCS SOFTWARE PROGRAM REVISION "1" FOR SYSTEM TEST, REVISION "1" FOR SPECIAL MOI TESTS

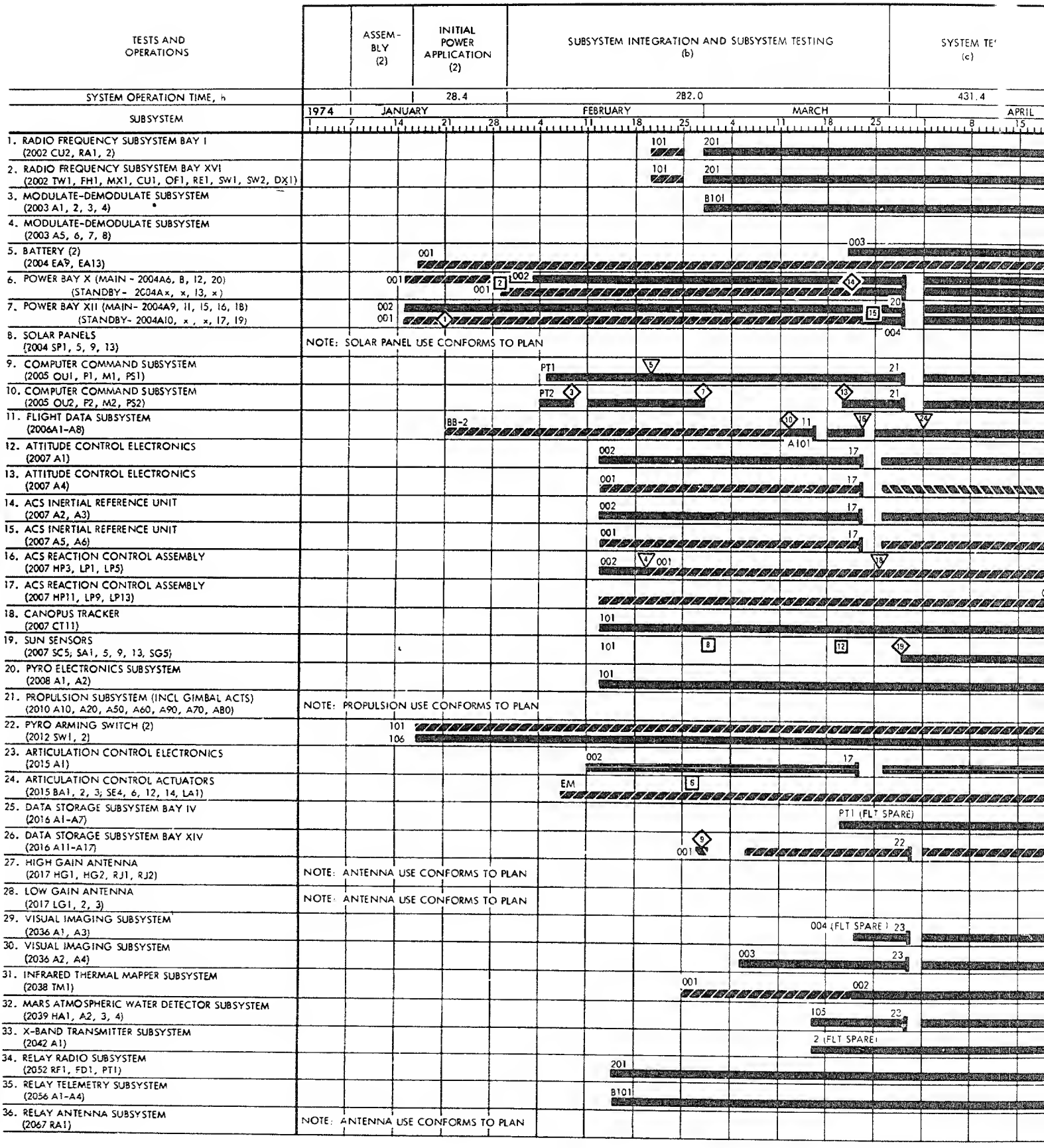
SUMMARY OF REMOVALS

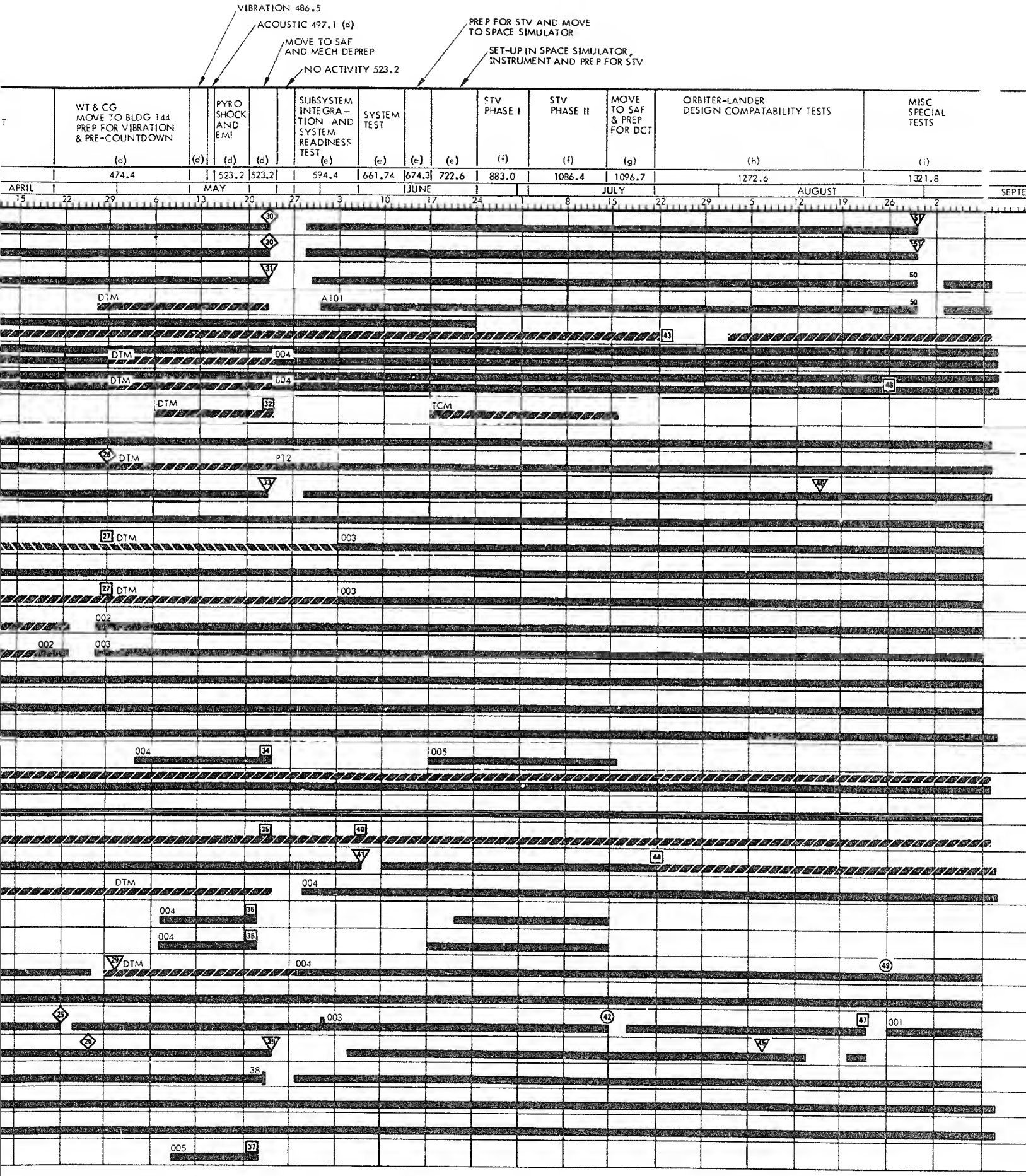
7-25-74	1	FDS 4A3 MODULE SN A102 RETURNED TO DIVISION TO ADD NOISE SUPPRESSION CIRCUITRY PER ECR 17937. RE-INSTALLED 7-29-74. R/RC 16328.
8-8-74	2	MDS MMU 3A7 SN C102 AND 3A8 SN C102 RETURNED TO DIVISION TO CHECK FOR ACTIVE MODE INDICATION MARGINAL AND FALSE TELEMETRY INDICATIONS. UNITS TESTED AT DIFFERENT TEMPERATURES FOR 13.4 HOURS BUT PROBLEMS DID NOT OCCUR. P/FR 34629 AND 34630. RE-INSTALLED 8-15-74. R/RC 170486.
8-13-74	3	FDS SN 001 (FLIGHT SPARE) REMOVED, SN 002 (VO-2 UNIT) INSTALLED. ALSO 4A3 MODULE SN A103 RETURNED TO DIVISION FOR CIRCUIT MODIFICATION TO CORRECT PHASE OF 2.4 KHZ CLOCK PER ECR 17995. RE-INSTALLED 8-15-74. R/RC 170500.
8-15-74	4	DSS SN 004 RETURNED TO DIVISION TO INCORPORATE TAPE INCREMENT COUNTER FIX. CIRCUIT WAS MODIFIED TO ELIMINATE ANY UNWANTED TACH PULSES PER ECR 17958. RE-INSTALLED 8-26-74. R/RC 16395.
8-16-74	5	FDS 6A7 SN A100 RETURNED TO DIVISION TO CHECK FOR IMPROPER DATA FOR VIS CONTROL WORD AND INCORRECT RESPONSE TO COMMAND PER P/FR 34634 AND 34635. REPLACED AN IC 54L95 IN THE 6A7A2. RE-INSTALLED 9-3-74. R/RC 16056.
8-27-74	6	VIS 36A4 SN 005 RETURNED TO DIVISION TO CHECK FOR LACK OF CONTINUITY FROM CONNECTOR TO GROUND. FOUND GROUND LUG SCREW NOT TIGHTENED. AREA WAS CLEANED, SCREW PROPERLY TORQUED AND AREA RE-COATED. RE-INSTALLED 8-29-74. R/RC 16065.
8-29-74	7	RFS BAY 1 SN 200 AND BAY 16 SN 203 RETURNED TO VENDOR FOR INVESTIGATION OF VCO PROBLEM. PTO UNIT INSTALLED SO SAF TESTS COULD CONTINUE.
8-29-74	8	MDS REMOVED AND RE-INSTALLED WITH RFS. (MDS SHARES BAY 1 WITH RFS).
8-30-74	9	MAWD SN 106 RETURNED TO DIVISION TO CHECK EXCESSIVE VARIATION IN DETECTOR OUTPUTS. THE PHASE-SHIFTER WAS RE-CALIBRATED AND UNIT RETURNED TO SAF. P/FR 34651. RE-INSTALLED 9-9-74. R/RC 16073.
9-11-74	10	6A1 AND 6A7 S/N A102 REPLACED WITH VO-2 6A1 AND 6A7 S/N A103; 6A3 S/N A102 REPLACED WITH VO-2 6A3 S/N A103 ON 9-16-74.
9-20-74	11	4A16 S/N 008 RETURNED TO DIVISION FOR ECR 18016. LIMIT INVERTER FREE RUN FREQUENCY SHIFT TO 20 Hz. RE-INSTALLED 10-7-74. R/RC 170214.
9-20-74	12	DTR BAY 14 FOR ECR 18005, REDUCE VIS DATA NOISE IN DSS; AND ECR 18008, LIMIT WORST CASE LOAD CURRENT. RE-INSTALLED 9-24-74. R/RC 170218
9-30-74	13	4A8 S/N 003 FOR ECR 17975 CHANGE CONNECTOR WIRING TO ALLOW 3 WIRES TO CARRY LOAD. VO-2 4A8 S/N 003 INSTALLED. R/RC 170225.
10-7-74	14	4A17 S/N 005 FOR ECR 18016, LIMIT INVERTER FREE RUN FREQUENCY SHIFT TO 20 Hz. VO-2 4A17 S/N 007 INSTALLED. R/RC 16120.
10-8-74	15	6A4 AND 6A6 S/N A103 FOR ECR 18043, MODIFY TO PREVENT AMBIGUITY IN MAWD DATA. REPLACED 10-11-74 R/RC 16123. ON 10-21-74 BOTH UNITS AGAIN REMOVED FOR FURTHER MODS FOR ECR 18043. RE-INSTALLED 10-22-74 R/RC 16149. ALSO ON 10-22-74 THE 6A3 S/N A103 WAS REMOVED FOR ECR 18065, TO CORRECT ERROR IN ECR 18039. RE-INSTALLED 10-24-74 R/RC 170734.
10-16-74	16	SP1 S/N 004 AND SP2 S/N 003 FOR ECR 18065, MODIFY CKT TO ALLOW MEMORY CLAMP THROUGH TIME TO RELEASE PRIOR TO PROCESSOR RESPONSE. RE-INSTALLED 10-22-74 (S/N 001 AND 002 INSTALLED DURING MOD). R/RC 170650.
10-18-74	17	3A5 S/N C104 ANOMALY AT CCS CMD INTERFACE. P/FR 34727. RETURNED TO DIVISION FOR CHECK, BUT SAF PROBLEM COULD NOT BE REPRODUCED. 3A5 S/N C105 (VO-2 UNIT) INSTALLED. R/RC 16152.
10-25-74	18	SOU1 S/N 003 AND SOU2 S/N 004 FOR ECR 18056, ADD ISOLATION DIODES TO EACH CC BUFFER DRIVER. RE-INSTALLED 10-30-74 (S/N 001 AND 002 INSTALLED DURING MOD). R/RC 16167.
11-27-74	19	CCS HARNESSES S/N 002 FOR ECR 18008, INSTALL CURRENT LIMITING RESISTORS IN 9W5 AND 9W55. R/RC 16258.
11-27-74	20	MAWD S/N 107 FOR ECR 18101, MODIFY TO ASSURE THAT CHOPPER WILL NOT START WHEN INSTRUMENT IS TURNED ON AT LOW FA TEMPERATURE LIMITS. R/RC 170674.
12-3-74	21	FDS S/N 002 FOR ECR 18091, CHANGE PHASE OF 30 kHz CLOCK AND ECR 18100, MEMORY LOAD ERROR MODIFICATION. R/RC 170681.
12-3-74	22	DSS S/N 004 FOR ECR 18050, INCREASE NOISE MARGIN, ALSO PROVIDE MORE ACCURATE TAPE POSITION INFORMATION. R/RC 16230.
12-3-74	23	DSS S/N 006 FOR ECR 18050, INCREASE NOISE MARGIN; ALSO, PROVIDE MORE ACCURATE TAPE POSITION INFORMATION. R/RC 16229.
12-11-74	24	4A20 S/N 003 FOR ECR 18070, INCREASE CONVERTER LOAD CAPACITY. R/RC 16222.
11-26-74	25	VIS S/N 005 AND 006 FOR ECRs 17909, 17910, 18031, 18071, 18077, ECNs 84016, AND 84057. RETESTED AS REQUIRED AFTER MODS. RE-INSTALLED 1-14-75. R/RC 170406.
12-2-74	26	MDS S/N C102 AND C103 FOR ECR 15064, ELIMINATE HF OSC ON COMPOSITE TELEMETRY SIGNAL. RE-INSTALLED 1-14-75. R/RC 110677
1-14-75	27	FDS 6A1 (POWER SUPPLY) S/N A103 AND 6A8 (MEMORY) S/N A102 FOR P/FR 34775. FDS POWER TURN ON AFTER RE-ASSEMBLY MEMORY A AND B CAME IN "POWER FAIL" CONDITION. 6A1 S/N A104 AND 6A8 S/N A101 INSTALLED 1-17-75. RE-INSTALLED 2-10-75. R/RC 170699
2-1-75	28	TCA HIGH PRESSURE MODULES S/N 006 & 007 REMOVED FOR FUNCTIONAL AND LEAK CHECKS. S/N 006 RE-INSTALLED 2-15-75. S/N 007 SHIPPED SEPARATELY AND INSTALLED AT ETR ON 2-26-75

NOTE

CERTAIN HARDWARE, SUCH AS SUN SENSORS, T.C. GAS SYSTEMS AND ACTUATORS ARE SUBJECT TO RELATIVELY FREQUENT REMOVAL & RE-INSTALLATION (R&R). THIS DOCUMENT DOES NOT RECORD SUCH R&Rs. DETAILS ARE DOCUMENTED IN SAF LOG BOOKS.

Figure 6. VO-2 Subsystem History


TESTS AND OPERATIONS
ASSEM-BLY (2)
INITIAL POWER APPLICATION (2)
SUBSYSTEM INTEGRATION AND SUBSYSTEM TESTING (b)
SYSTEM TE (c)
SYSTEM OPERATION TIME, h
28.4
282.0
431.4
SUBSYSTEM
1974
JANUARY
FEBRUARY
MARCH
APRIL
1. RADIO FREQUENCY SUBSYSTEM BAY I (2002 CU2, RA1, 2)
2. RADIO FREQUENCY SUBSYSTEM BAY XVI (2002 TW1, FH1, MX1, CU1, OF1, RE1, SW1, SW2, DX1)
3. MODULATE-DEMODULATE SUBSYSTEM (2003 A1, 2, 3, 4)
4. MODULATE-DEMODULATE SUBSYSTEM (2003 A5, 6, 7, 8)
5. BATTERY (2) (2004 EA9, EA13)
6. POWER BAY X (MAIN - 2004A6, B, I2, 20) (STANDBY - 2004Ax, x, I3, x)
7. POWER BAY XII (MAIN - 2004A9, II, I5, I6, I8) (STANDBY - 2004AI0, x, x, I7, I9)
8. SOLAR PANELS (2004 SP1, 5, 9, 13)
NOTE: SOLAR PANEL USE CONFORMS TO PLAN
9. COMPUTER COMMAND SUBSYSTEM (2005 OU1, P1, M1, PS1)
10. COMPUTER COMMAND SUBSYSTEM (2005 OU2, P2, M2, PS2)
11. FLIGHT DATA SUBSYSTEM (2006A1-A8)
12. ATTITUDE CONTROL ELECTRONICS (2007 A1)
13. ATTITUDE CONTROL ELECTRONICS (2007 A4)
14. ACS INERTIAL REFERENCE UNIT (2007 A2, A3)
15. ACS INERTIAL REFERENCE UNIT (2007 A5, A6)
16. ACS REACTION CONTROL ASSEMBLY (2007 HP3, LP1, LP5)
17. ACS REACTION CONTROL ASSEMBLY (2007 HP11, LP9, LP13)
18. CANOPUS TRACKER (2007 CT11)
19. SUN SENSORS (2007 SC5; SA1, 5, 9, 13, SG5)
20. PYRO ELECTRONICS SUBSYSTEM (2008 A1, A2)
21. PROPULSION SUBSYSTEM (INCL GIMBAL ACTS) (2010 A10, A20, A50, A60, A90, A70, AB0)
NOTE: PROPULSION USE CONFORMS TO PLAN
22. PYRO ARMING SWITCH (2) (2012 SW1, 2)
23. ARTICULATION CONTROL ELECTRONICS (2015 A1)
24. ARTICULATION CONTROL ACTUATORS (2015 BA1, 2, 3; SE4, 6, 12, 14, LA1)
25. DATA STORAGE SUBSYSTEM BAY IV (2016 A1-A7)
26. DATA STORAGE SUBSYSTEM BAY XIV (2016 A11-A17)
27. HIGH GAIN ANTENNA (2017 HG1, HG2, RJ1, RJ2)
NOTE: ANTENNA USE CONFORMS TO PLAN
28. LOW GAIN ANTENNA (2017 LG1, 2, 3)
NOTE: ANTENNA USE CONFORMS TO PLAN
29. VISUAL IMAGING SUBSYSTEM (2036 A1, A3)
30. VISUAL IMAGING SUBSYSTEM (2036 A2, A4)
31. INFRARED THERMAL MAPPER SUBSYSTEM (2038 TM1)
32. MARS ATMOSPHERIC WATER DETECTOR SUBSYSTEM (2039 HA1, A2, 3, 4)
33. X-BAND TRANSMITTER SUBSYSTEM (2042 A1)
34. RELAY RADIO SUBSYSTEM (2052 RF1, FD1, PT1)
35. RELAY TELEMETRY SUBSYSTEM (2056 A1-A4)
36. RELAY ANTENNA SUBSYSTEM (2067 RA1)
NOTE: ANTENNA USE CONFORMS TO PLAN


VIBRATION 486.5
ACOUSTIC 497.1 (d)
MOVE TO SAF AND MECH DEPREP
NO ACTIVITY 523.2
PREP FOR STV AND MOVE TO SPACE SIMULATOR
SET-UP IN SPACE SIMULATOR, INSTRUMENT AND PREP FOR STV
T
WT & CG MOVE TO BLDG 144 PREP FOR VIBRATION & PRE-COUNTDOWN
(d)
(d)
PYRO SHOCK AND EMI
(d)
(d)
SUBSYSTEM INTEGRA-TION AND SYSTEM READINESS TEST
(e)
SYSTEM TEST
(e)
(e)
(e)
STV PHASE I
(f)
STV PHASE II
(f)
MOVE TO SAF & PREP FOR DCT
(g)
ORBITER-LANDER DESIGN COMPATABILITY TESTS
(h)
MISC SPECIAL TESTS
(i)
474.4
523.2
523.2
594.4
661.74
674.3
722.6
883.0
1086.4
1096.7
1272.6
1321.8
APRIL
MAY
JUNE
JULY
AUGUST
SEPTE
15 22 29 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 2
DTM
A101
TCM
PT2
003
004
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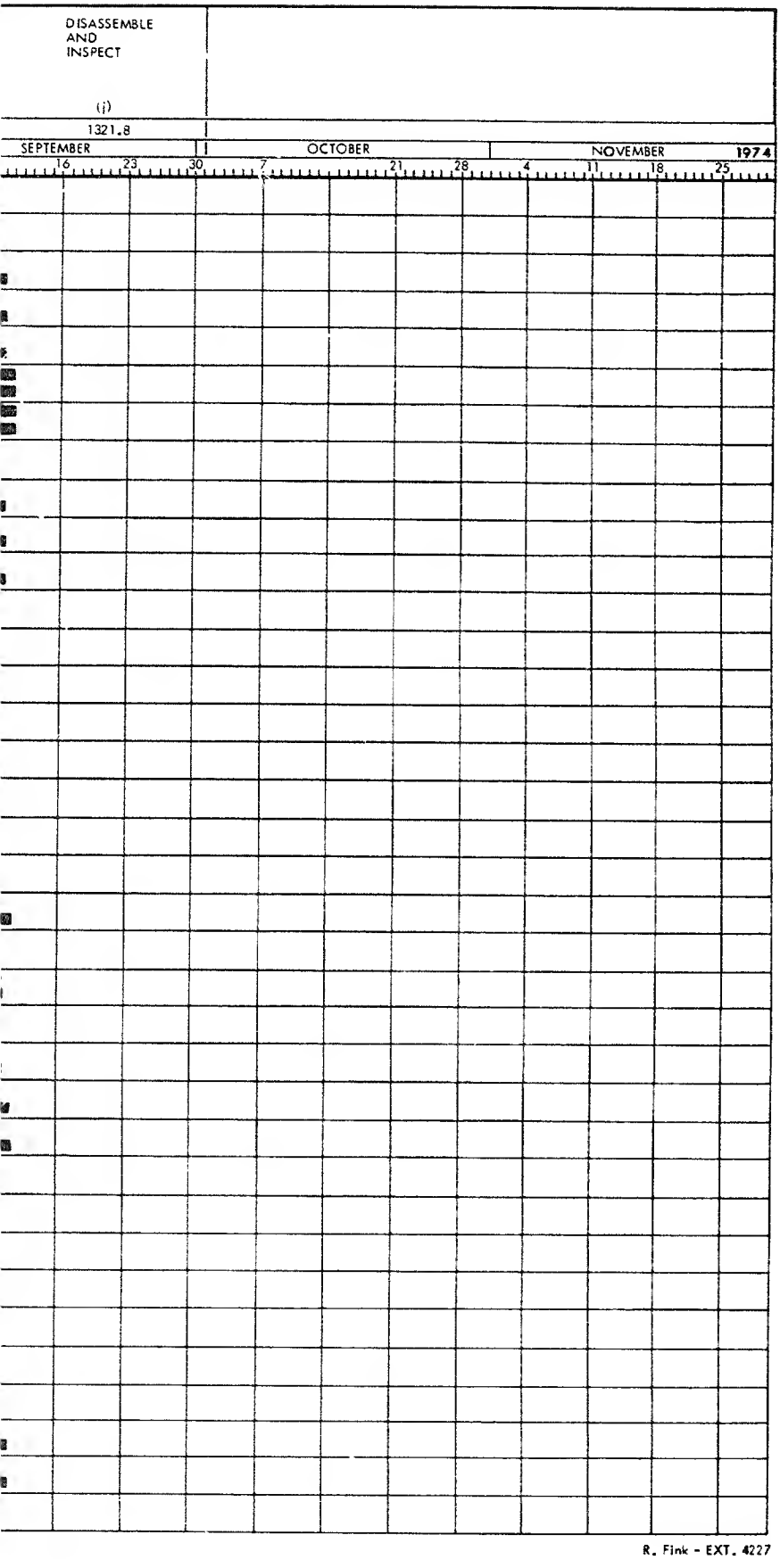
VIKING ORBITER 1975
VO-1 S/C HISTORY (PTO)

AS OF 9-11-74
NUMBER 3



R. Fink - EXT. 4227

LEGEND:

XXXXX ← ASSEMBLY SERIAL NUMBER
PTM SUBSYSTEM INSTALLED

PROTOTYPE SUBSYSTEM INSTALLED

REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM

P/FR, REMOVAL OF SUBSYSTEM FOR

ECR, REMOVAL OF SUBSYSTEM FOR

SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/OR CALIBRATION

SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/FR SUMMARY

		S/C
(a)	34001 THRU 34025 WERE WRITTEN DURING ASSEMBLY AND INITIAL POWER APPLICATION	10
(b)	34026 THRU 34147 WERE WRITTEN DURING SUBSYSTEM INTEGRATION AND SUBSYSTEM TESTING	59
(c)	34148 THRU 34204 WERE WRITTEN DURING SYSTEM TEST	26
(d)	34205 THRU 342B0 WERE WRITTEN DURING SYSTEM TEST	51
(e)	342B1 THRU 34324 WERE WRITTEN DURING SUBSYSTEM INTEGRATION THRU PREP FOR STV	24
(f)	34325 THRU 34363 WERE WRITTEN DURING STV PHASE I AND II	25
(g)	34364 THRU 34389 WERE WRITTEN DURING SRT	11
(h)	34390 THRU 34427 WERE WRITTEN DURING DCT	19
(i)	34428 THRU 34447 WERE WRITTEN DURING SPECIAL TESTS	15

SUMMARY OF REMOVALS

1-21-74 ◇1 POWER BREADBOARD 4A10 BOOSTER REGULATOR OUT OF
RETURNED TO DIV 1-21-74 AND FOUND LOOSE CKT BOA
WAS PLUGGED IN PROPERLY AND SECURED WITH SCREWS
STALLED 1-21-74 P/FR 34009, R/RC 16425 PPM 4A17 S/N0
RETURNED TO DIV 1-21-74 FOR EVALUATION. REINSTALL
R/RC 16426. BOTH UNITS RETURNED TO DIV 1-22-74, 88
COLD SOLDER JOINT, 4A17 HAD STYCAST BROKEN AT ST
BOTH UNITS REINSTALLED 4-22-74 R/RC 138074 AND R/F
4A10BB REMOVED AGAIN ON 1-25-74 TO BONDED STORE

1-29-74 [2] POWER PPM MODULES REMOVED, REPLACED WITH PTO 4A
4A12 AND 4A20 ALL S/N002

2-8-74 ◇3 CCS HARNESS 9W5/9W55 REMOVED, CONNECTOR PINS C
WITH RESIDUE. CONNECTORS CLEANED AND GIVEN PIN
TION TEST, PASSED TEST, REINSTALLED 2-11-74. P/FR 34
R/RC 16429.

2-20-74 ▽4 ACS PTO LOW PRESSURE MODULE S/N002 REMOVED FOR
CATION TO ALLOW RELOCATION OF MANIFOLD TO MO
RADIALLY ALONG THE SOLAR PANEL SPAR TIE. PPM S/N
INSTALLED. ECR 17669.

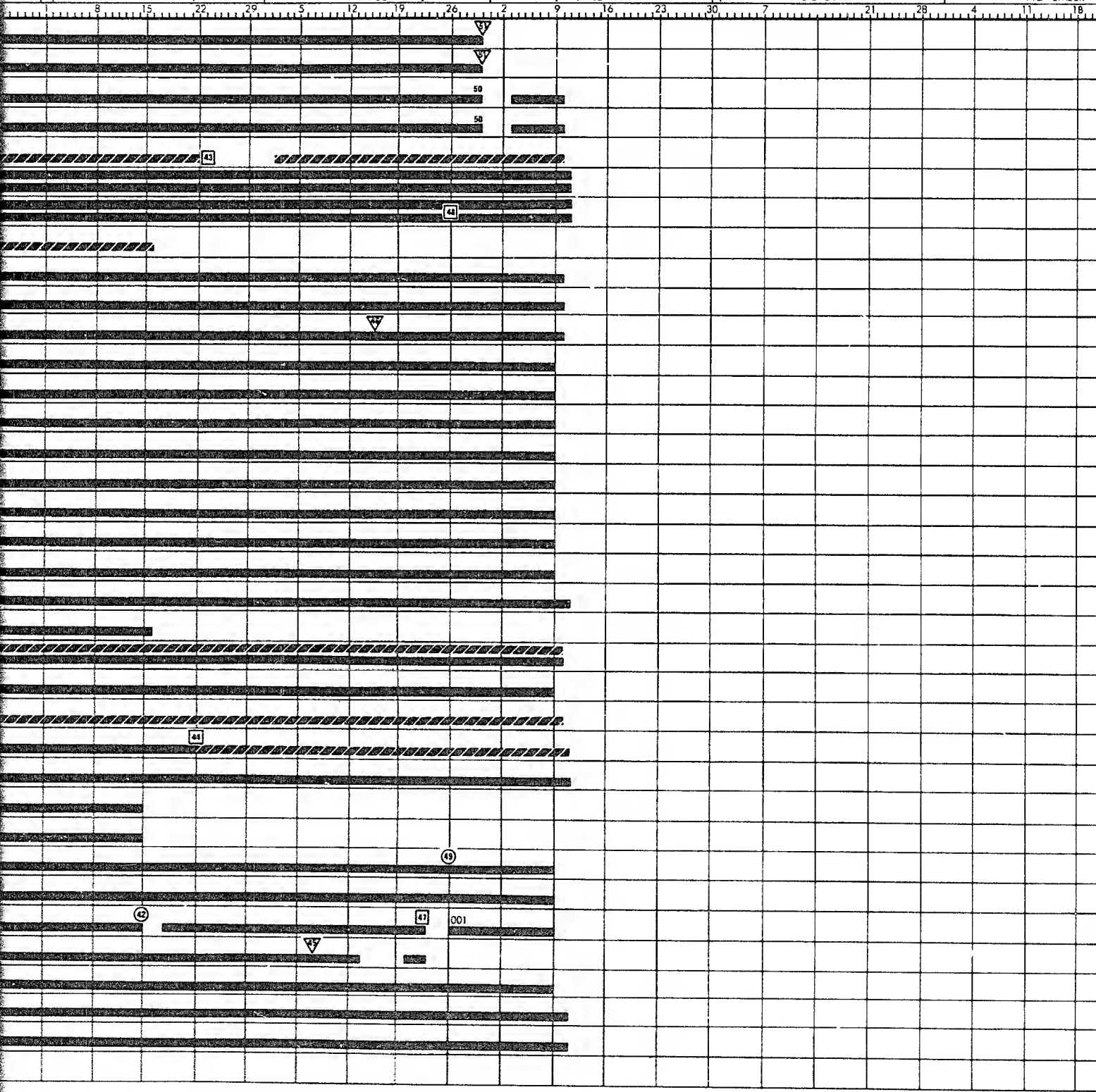
2-21-74 ▽5 CCS SOU1/2 S/NPT 2 REMOVED FOR ECR 17657 WHICH MO
SOU1/2 TO SWITCH TLM DATA TO TRAILING EDGE OF BIT
S/N PT-1 (MODIFIED PREVIOUSLY) INSTALLED. REINSTAL
2-25-74. R/RC 16444.

2-27-74 [6] ACTUATOR BA3 S/N102 (TA) REPLACED WITH BA3 S/N 103
INSTALLED 3-1-74. R/RC 16445.

P FOR STV AND MOVE
SPACE SIMULATOR

SET-UP IN SPACE SIMULATOR,
INSTRUMENT AND PREP FOR STV

STV PHASE I	STV PHASE II	MOVE TO SAF & PREP FOR DCT	ORBITER-LANDER DESIGN COMPATABILITY TESTS	MISC SPECIAL TESTS	DISASSEMBLE AND INSPECT	
(f)	(f)	(g)	(h)	(i)	(j)	
883.0	1086.4	1096.7	1272.6	1321.8	1321.8	



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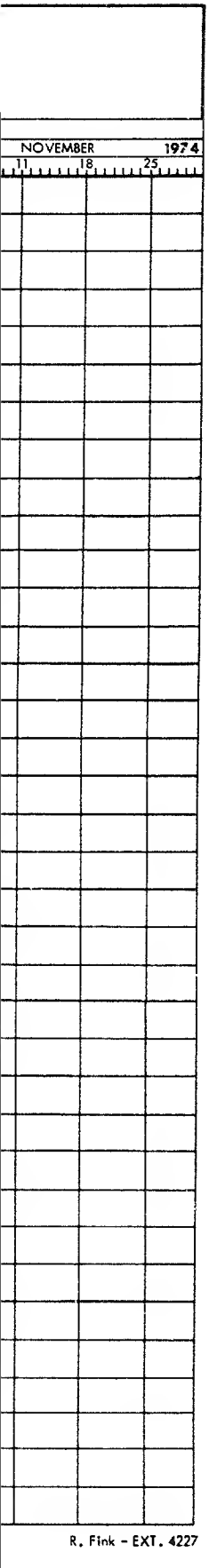
VIKING ORBITER 1975
VO-1 S/C HISTORY (PTO)

AS OF 9-11-74
NUMBER 3



R. Fink - EXT. 4227

LEGEND:

XXXXX ← ASSEMBLY SERIAL NUMBER
PTM SUBSYSTEM INSTALLED

PROTOTYPE SUBSYSTEM INSTALLED

REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM

P/FR, REMOVAL OF SUBSYSTEM FOR

ECR, REMOVAL OF SUBSYSTEM FOR

SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/OR CALIBRATION

SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/FR SUMMARY

		S/C	OSE
(a)	34001 THRU 34025 WERE WRITTEN DURING ASSEMBLY AND INITIAL POWER APPLICATION	10	15
(b)	34026 THRU 34147 WERE WRITTEN DURING SUBSYSTEM INTEGRATION AND SUBSYSTEM TESTING	59	63
(c)	3414B THRU 34204 WERE WRITTEN DURING SYSTEM TEST	26	31
(d)	34205 THRU 342B0 WERE WRITTEN DURING SYSTEM TEST	51	24
(e)	342B1 THRU 34324 WERE WRITTEN DURING SUBSYSTEM INTEGRATION THRU PREP FOR STV	24	19
(f)	34325 THRU 34363 WERE WRITTEN DURING STV PHASE I AND II	25	14
(g)	34364 THRU 34389 WERE WRITTEN DURING SRT	11	15
(h)	34390 THRU 34427 WERE WRITTEN DURING DCT	19	19
(i)	3442B THRU 34447 WERE WRITTEN DURING SPECIAL TESTS	15	5

SUMMARY OF REMOVALS

1-21-74 ◇1 POWER BREADBOARD 4A10 BOOSTER REGULATOR OUT OF TOLERANCE. RETURNED TO DIV 1-21-74 AND FOUND LOOSE CKT BOARD, BOARD WAS PLUGGED IN PROPERLY AND SECURED WITH SCREWS. REINSTALLED 1-21-74 P/FR 34009, R/RC 16425. PPM 4A17 S/N002 RETURNED TO DIV 1-21-74 FOR EVALUATION. REINSTALLED 1-21-74 R/RC 16426. BOTH UNITS RETURNED TO DIV 1-22-74, BB 4A10 HAD COLD SOLDER JOINT, 4A17 HAD STYCAST BROKEN AT STANDOFF. BOTH UNITS REINSTALLED 4-22-74. R/RC 138074 AND R/RC 138073. 4A10B8 REMOVED AGAIN ON 1-25-74 TO BONDED STORES.

1-29-74 □2 POWER PPM MODULES REMOVED, REPLACED WITH PTO 4A6, 4A8, 4A12 AND 4A20 ALL S/N002.

2-8-74 ◇3 CCS HARNESS 9W5/9W55 REMOVED, CONNECTOR PINS COATED WITH RESIDUE. CONNECTORS CLEANED AND GIVEN PIN RETENTION TEST, PASSED TEST, REINSTALLED 2-11-74. P/FR 34026 R/RC 16429.

2-20-74 ▽4 ACS PTO LOW PRESSURE MODULE S/N002 REMOVED FOR MODIFICATION TO ALLOW RELOCATION OF MANIFOLD TO MOUNT RADIALLY ALONG THE SOLAR PANEL SPAR TIE. PPM S/N001 INSTALLED. ECR 17669.

2-21-74 ▽5 CCS 5OUI/2 S/NPT 2 REMOVED FOR ECR 17657 WHICH MODIFIED 5OU1/2 TO SWITCH TLM DATA TO TRAILING EDGE OF BIT SYNC. S/N PT-1 (MODIFIED PREVIOUSLY) INSTALLED. REINSTALLED 2-25-74. R/RC 16444.

2-27-74 □6 ACTUATOR 8A3 S/N102 (TA) REPLACED WITH 8A3 S/N 103 FLT INSTALLED 3-1-74. R/RC 16445.

2-28-74 ◇7 CCS P2 S/NPT1 REMOVED TO R[illegible]VR LOS BILITY. FLEX HARNESS CONN[illegible]OR JB OUI, PS1, P1 S/N PT1 REMOVE[illegible]POWD NECTORS CLEANED AND REINS[illegible]LED 3 CONTINUED WITH OTHER 1/2 [illegible]CCS).

2-28-74 □8 EM SUNSENSORS 7SC5 S/N101 [illegible]D 7SC 2-28-74 WITH PTO SENSORS 7S[illegible]S/N10

2-28-74 ◇9 DSS PROTO S/N001 REMOVED, [illegible]K IMPE CHASSIS AND SIGNAL GROU[illegible]. REWO DIV LAB. REINSTALLED 3-6-74 R/RC 1[illegible]

3-12-74 ◇10 FDS PTO 6A3 S/N101 RETURNE[illegible] TO DIVI P/RF 31370. 6A4 S/NA101 RETU[illegible]RNED TO 2K RESISTOR FLAT PACK WITH 10K FLAT 3-13-74. R/RC 170022. FDS PTO 6A3 S/[illegible] DIVISION AGAIN ON 3-13-74 TO MOD CHANGE INTERNAL WIRING TO ELIMIN BETWEEN MDS & FDS. ECR 17741, PFR 3- R/RC 16455.

3-16-74 11 CHASSIS BAY VI REMOVED TO ADD CON CHANGE FLAT MOUNTING SHIMS TO W ECR 17666 & 1766B. REINSTALLED 3-18-[illegible]

3-20-74 □12 EM SUN SENSORS 7SA1 S/N101 AND 7SA 3-22-74 WITH PTO SENSORS 7SA1 S/N10 R/RC 170024.

3-21-74 ◇13 CCS S/NPT1 REMOVED TO INSPECT CON RESIDUE FOUND ON A FEW PINS, THESE MODULES REINSTALLED 3-22-74 AFTER M THREE TIMES.

3-22-74 ◇14 PWR PTO 4A20 S/N002 TO BENCH TEST F WAS OVERLOADED DURING PROP ISOLA TEST AT SAF ON 3-18-74, P/FR 34117. [illegible] STRESS FOUND. REINSTALLED 3/26/7[illegible]

3-23-74 □15 PPM POWER MODULES 4A10, 13, 17, & WITH FLIGHT MODULES ALL S/N004. R/[illegible]

3-23-74 ▽16 FDS 6A4, 6A5, 6A6 S/NA101 FOR TEST A WAS MODIFIED TO CHANGE S-X PHASE PROCESS DATA PROPERLY. ECR 17776, P/FR 34114. REINSTALLED 3-25-74 R/RC

3-23-74 17 CHASSIS BAY V REMOVED TO ADD CON CHANGE FLAT MOUNTING SHIMS TO W ECR 17666 & 1766B. REINSTALLED 3-26-[illegible]

3-26-74 ▽18 ACS PTO HPM S/N002 FOR MODIFICATIO HELIUM WITH ACS N_2 GAS SYSTEM, ECR INSTALLED. REINSTALLED 4-19-74 R/RC

3-29-74 ◇19 SUN SENSOR 7SC5 S/N102 RETURNED TO LOOSE INSERT. REINSTALLED 4-1-74, REMOVED AGAIN 4-3-74 TO FIX BIASIN REINSTALLED 4-4-74. R/RC 170042.

3-29-74 20 CHASSIS BAY X AND XII REMOVED TO C SHIMS TO WRAP-AROUND TYPE PER ECR

3-29-74 21 CHASSIS BAY II REMOVED TO ADD CON CHANGE FLAT MOUNTING SHIMS TO W ECR 17666 & 17668. REINSTALLED 4-1-74

3-29-74 22 CHASSIS BAY XIV REMOVED TO CHANG TO WRAP-AROUND TYPE PER ECR 17668.

3-29-74 23 CHASSIS BAY VIII REMOVED TO ADD CO CHANGE FLAT MOUNTING SHIMS TO W ECR 17666 & 17668. REINSTALLED 4-1-74

4-1-74 ▽24 FDS 6A3 & 6A6 S/NA101 RETURNED TO D MODIFICATION. 6A3 REWORK OF PREV P/FR 31372. 6A6 TO MODIFY TO PROVI MAWD CONTROL COMMAND CC39D. E 4-2-74. R/RC 170045.

4-22-74 ◇25 IRTM RETURNED TO DIVISION FOR REPAI AND TO RE-CHARGE DETECTORS. RE-IN R/RC 16475.

4-26-74 ◇26 MAWD HEAD REMOVED TO RE-ROUTE CA OF CONNECTOR. RE-INSTALLED 4-27-74

4-29-74 □27 ACE & IRU S/N001 (PPM) MODULES NOT REPLACED WITH DTM MODULES. DTM MO SPARE S/N003 ON 6-3-74.

4-30-74 ◇28 CCS S/N PT2 MODULES M1 AND P1 FOR AND REPAIRED INCORRECTLY ROUTED HA ASSOCIATED IC. M1 WAS NOT TOUCHED CORROSION (OK) AND CLEANING OF C 203, 204 & 213. REINSTALLED 5-28-74. R/

5-1-74 ▽29 VIS SN004 TO CHANGE BIAS RESISTORS TORTION PER ECR 17820. RE-INSTALLED

5-23-74 ◇30 RFS TWTA-2 CONTROL UNIT FAILURE ON TION AND SUBSEQUENT TESTS CONTINU UNIT REPAIRED AND TWTA-2 REPLACED. R/RC170183.

2-28-74 (7) CCS P2 S/NPT1 REMOVED TO REPAIR LOSS OF COMMAND CAPABILITY. FLEX HARNESS CONNECTOR J8 REPLACED. MODULES M1, OU1, PS1, P1 S/N PT1 REMOVED, POWDERY RESIDUE ON CONNECTORS CLEANED AND REINSTALLED 3-20-74. (S/C TESTING CONTINUED WITH OTHER 1/2 OF CCS). P/FR 34079, RR/C 16450.

2-28-74 [8] EM SUNSENSORS 7SC5 S/N101 AND 7SG5 S/N101 REPLACED 2-28-74 WITH PTO SENSORS 7SC5 S/N102 AND 7SG5 S/N102.

2-28-74 (9) DSS PROTO S/N001 REMOVED, 5K IMPEDENCE MEASURED BETWEEN CHASSIS AND SIGNAL GROUND. REWORKED AND RETESTED IN DIV LAB. REINSTALLED 3-6-74. R/RC 16437.

3-12-74 (10) FDS PTO 6A3 S/N101 RETURNED TO DIVISION TO REPLACE 54L00. P/RF 31370. 6A4 S/NA101 RETURNED TO DIVISION TO REPLACE 2K RESISTOR FLAT PACK WITH 10K FLAT PACK. UNITS REINSTALLED 3-13-74. R/RC 170022. FDS PTO 6A3 S/NA101 RETURNED TO DIVISION AGAIN ON 3-13-74 TO MODIFY CASE HARNESS AND CHANGE INTERNAL WIRING TO ELIMINATE A GROUND LOOP BETWEEN MDS & FDS. ECR 17741, PFR 34094. REINSTALLED 3-14-74. R/RC 16455.

3-16-74 11 CHASSIS BAY VI REMOVED TO ADD CONNECTOR SPACERS AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668. REINSTALLED 3-18-74.

3-20-74 [12] EM SUN SENSORS 7SA1 S/N101 AND 7SA5 S/N102 REPLACED 3-22-74 WITH PTO SENSORS 7SA1 S/N109 AND 7SA5 S/N111. R/RC 170024.

3-21-74 (13) CCS S/NPT1 REMOVED TO INSPECT CONNECTOR PINS. SLIGHT RESIDUE FOUND ON A FEW PINS, THESE WERE CLEANED AND MODULES REINSTALLED 3-22-74 AFTER MATE AND DEMATE THREE TIMES.

3-22-74 (14) PWR PTO 4A20 S/N002 TO BENCH TEST FOR OVERSTRESS. UNIT WAS OVERLOADED DURING PROP ISOLATION VALVE ACTUATION TEST AT SAF ON 3-18-74, P/FR 34117. NO EVIDENCE OF OVERSTRESS FOUND. REINSTALLED 3/26/74 R/RC 170025.

3-23-74 [15] PPM POWER MODULES 4A10, 13, 17, & 19 REPLACED WITH FLIGHT MODULES ALL S/N004. R/RC 170026.

3-23-74 (16) FDS 6A4, 6A5, 6A6 S/NA101 FOR TEST AND EVALUATION. 6A4 WAS MODIFIED TO CHANGE S-X PHASE DATA SO MTC CAN PROCESS DATA PROPERLY. ECR 17776, REPL 54L00 IN 6A6, P/FR 34114. REINSTALLED 3-25-74 R/RC 170031.

3-23-74 17 CHASSIS BAY V REMOVED TO ADD CONNECTOR SPACERS AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668. REINSTALLED 3-26-74.

3-26-74 (18) ACS PTO HPM S/N002 FOR MODIFICATION TO CROSS USE HP HELIUM WITH ACS N_2 GAS SYSTEM, ECR 17734. PPM S/N001 INSTALLED. REINSTALLED 4-19-74 R/RC 16461.

3-29-74 (19) SUN SENSOR 7SC5 S/N102 RETURNED TO DIV FOR REWORK OF LOOSE INSERT. REINSTALLED 4-1-74. P/FR 34068 R/RC 170034 REMOVED AGAIN 4-3-74 TO FIX BIASING IN (SE) LIGHT HOOD. REINSTALLED 4-4-74. R/RC 170042.

3-29-74 20 CHASSIS BAY X AND XII REMOVED TO CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17668. REINSTALLED 4-1-74.

3-29-74 21 CHASSIS BAY II REMOVED TO ADD CONNECTOR SPACERS AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668. REINSTALLED 4-1-74.

3-29-74 22 CHASSIS BAY XIV REMOVED TO CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17668. REINSTALLED 4-1-74.

3-29-74 23 CHASSIS BAY VIII REMOVED TO ADD CONNECTOR SPACERS AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668 REINSTALLED 4-1-74.

4-1-74 (24) FDS 6A3 & 6A6 S/NA101 RETURNED TO DIV FOR REWORK AND MODIFICATION. 6A3 REWORK OF PREVIOUS ECR 17741 MOD, P/FR 31372. 6A6 TO MODIFY TO PROVIDE PROPER CODE FOR MAWD CONTROL COMMAND CC39D. ECR 17779. REINSTALLED 4-2-74. R/RC 170045.

4-22-74 (25) IRTM RETURNED TO DIVISION FOR REPAIR OF LOOSE CONNECTOR STUD AND TO RE-CHARGE DETECTORS. RE-INSTALLED 4-24-74. P/FR 34131, R/RC 16475.

4-26-74 (26) MAWD HEAD REMOVED TO RE-ROUTE CABLE TO ALLOW PROPER MATING OF CONNECTOR. RE-INSTALLED 4-27-74. P/FR 34209.

4-29-74 [27] ACE & IRU S/N001 (PPM) MODULES NOT QUALIFIED FOR TA VIBRATION, REPLACED WITH DTM MODULES. DTM MODULES REPLACED WITH FLIGHT SPARE S/N003 ON 6-3-74.

4-30-74 (28) CCS S/N PT2 MODULES M1 AND P1 FOR PROCESSOR ERRORS. FOUND AND REPAIRED INCORRECTLY ROUTED HAYWIRE IN P1. ALSO REPLACED ASSOCIATED IC. M1 WAS NOT TOUCHED. BOTH UNITS INSPECTED FOR CORROSION (OK) AND CLEANING OF CONNECTORS. P/FRs 34202, 203, 204 & 213. REINSTALLED 5-2a-74. R/RC 16499.

5-1-74 (29) VIS SN004 TO CHANGE BIAS RESISTORS TO REDUCE LINE SWEEP DISTORTION PER ECR 17820. RE-INSTALLED 5-28-74. R/RC 170112.

5-23-74 (30) RFS TWTA-2 CONTROL UNIT FAILURE ON 5-8-74, P/FR 34246. VIBRATION AND SUBSEQUENT TESTS CONTINUED USING TWTA-1. CONTROL UNIT REPAIRED AND TWTA-2 REPLACED. RE-INSTALLED 5-29-74. R/RC170183.

5-23-74 (31) MDS S/N B101 (PTO) TO INCORPORATE ECRs 17893, 17778, & 17825; MODIFICATION TO ELIMINATE RACE CONDITION IN CDU LOGIC, TO INVERT POLARITY OF PLAYBACK DATA BETWEEN DSS & MDS, AND TO ELIMINATE HIGH FREQUENCY OSCILLATION ON TLM AT RFS INTERFACE. RE-INSTALLED 5-30-74. R/RC 16514, 16518 AND 16520.

5-23-74 [32] SOLAR PANELS (DTM) REMOVED, NO FURTHER TESTS ON PTO REQUIRED. SPECIAL STUB PANELS FROM TCM WILL BE INSTALLED FOR STV TEST.

5-23-74 (33) FDS S/N A101 PTO TO INCORPORATE ECRs 17777, 17869, 17196, 17846 & 17848 FOR MODIFICATION OF 3A1 TO REMOVE SINGLE POINT FAILURE IN VIS INTERFACE, AND TO CHANGE VALUES OF PICK-UP RESISTORS; 4A2 TO MODIFY SNR INTERFACE AND CORRECT IRTM SEQUENCE; 7A1 & 7A2 TO MODIFY VIS INTERFACE AND TO INSTALL NATIONAL 54L 95s IN VIS PROCESSOR. RE-INSTALLED 5-29-74. R/RC 16513.

5-23-74 [34] PROPULSION SYSTEM S/N004 REMOVED, NO FURTHER REQUIREMENT. SPARE SYSTEM S/N005 INSTALLED 6-17-74 FOR STV.

5-23-74 [35] SOLAR ENERGY CONTROLLERS (SECs) REMOVED AND STORED FOR PROTECTION. NO FURTHER REQUIREMENT UNTIL STV TESTS. SEC ACTUATORS SE 4,6,12, AND 14 ALSO REMOVED, RE-INSTALLED ON TEST BRACKETS 5-29-74. SECs AND SEC ACTUATORS RE-INSTALLED ON PTO 6-15-74 FOR STV TEST

5-23-74 [36] LOW AND HIGH GAIN ANTENNAS REMOVED, NOT REQUIRED UNTIL STV TEST.

5-23-74 [37] RELAY ANTENNA REMOVED, NOT REQUIRED FOR STV.

5-23-74 38 XTX S/N 2 FOR ACCESS TO COAX CABLING IN STRUCTURE IN AREA OF BAY 1. RE-INSTALLED 5-28-74.

5-24-74 (39) MAWD S/N105 (PTO) FOR ECR 17784, MODIFICATION TO THE CALIBRATION LAMP DRIVE CIRCUIT TO DECOUPLE THE LAMP DRIVE CURRENT FROM THE +12 VOLT SUPPLY. RE-INSTALLED 6-5-74. R/RC 16517.

6-7-74 [40] ACTUATORS CONFIGURATION FOR STV - 15BA1 S/N 104, 15BA2 S/N EM3, 15BA3 S/N001, 15LA1 S/N EM001.

6-7-74 (41) DSS S/N PT1 MODULES A2 AND A7 RETURNED TO DIVISION TO MODIFY DATA STROBE AND ENABLE CIRCUITRY PER ECR 17830 FOR NOISE IMMUNIZATION. RE-INSTALLED 6-10-74. R/RC 16404

7-15-74 (42) IRTM S/N 003 RETURNED TO VENDOR FOR BACKFILL OF DETECTORS AND REFURBISHMENT. REINSTALLED 7-18-74. R/RC 16375.

7-22-74 (43) TEST BATTERY REMOVED TO INSTALL ON VO-2. REINSTALLED 8-2-74.

7-22-74 [44] DSS FLIGHT SPARE SN PT1 REMOVED AND THE PROTO DSS S/N 001 INSTALLED.

8-7-74 (45) MAWD HEAD ASSEMBLY S/N 105 RETURNED TO DIVISION FOR NEW LATCH DESIGN PER ECI 83678 AND 83691. ELECTRONICS MODULES B-14-74 TO CHECK OUT NEW LATCH DESIGN. IN ADDITION TWO RESISTORS WERE REPLACED PER ECI 83988 AND 83989. RE-INSTALLED 8-20-74. R/RC 170501.

8-15-74 (46) FDS MODULE 6A3 S/N A101 RETURNED TO DIVISION FOR MODIFICATION TO REDUCE NOISE DUE TO VIS FLYBACK DATA. S/N A102 INSTALLED. S/N A101 RE-INSTALLED B-19-74. R/RC 170502.

8-23-74 [47] IRTM S/N 003 REMOVED TO RE-INSTALL PTO UNIT S/N 001 WHICH HAD BEEN RETURNED TO VENDOR FOR ENGINEERING EVALUATION. DETECTORS WERE BACKFILLED PRIOR TO RE-DELIVERY. S/N 001 RE-INSTALLED 8-26-74. R/RC 16465.

8-26-74 [48] PWR 4A10 S/N 003 (BOOSTER REGULATOR) REMOVED AND THE BB 4A10 INSTALLED TO USE FOR SPECIAL 20% VOLTAGE OVERLOAD TEST. FOLLOWING THE TEST THE PTO 4A11 S/N 002 AND THE 4A17 S/N 003 WERE REMOVED (8-30-74) AND RETURNED TO VENDOR FOR EVALUATION. THE 4A11 PPM S/N 001 WAS INSTALLED. THREE SHORTED ZENER DIODES WERE REPLACED IN THE 4A11 S/N 002. BOTH UNITS RETESTED AND RETURNED TO JPL. ALL ORIGINAL MODULES 4A10 S/N 003, 4A11 S/N 002 AND 4A17 S/N 003 RE-INSTALLED 9-6-74.

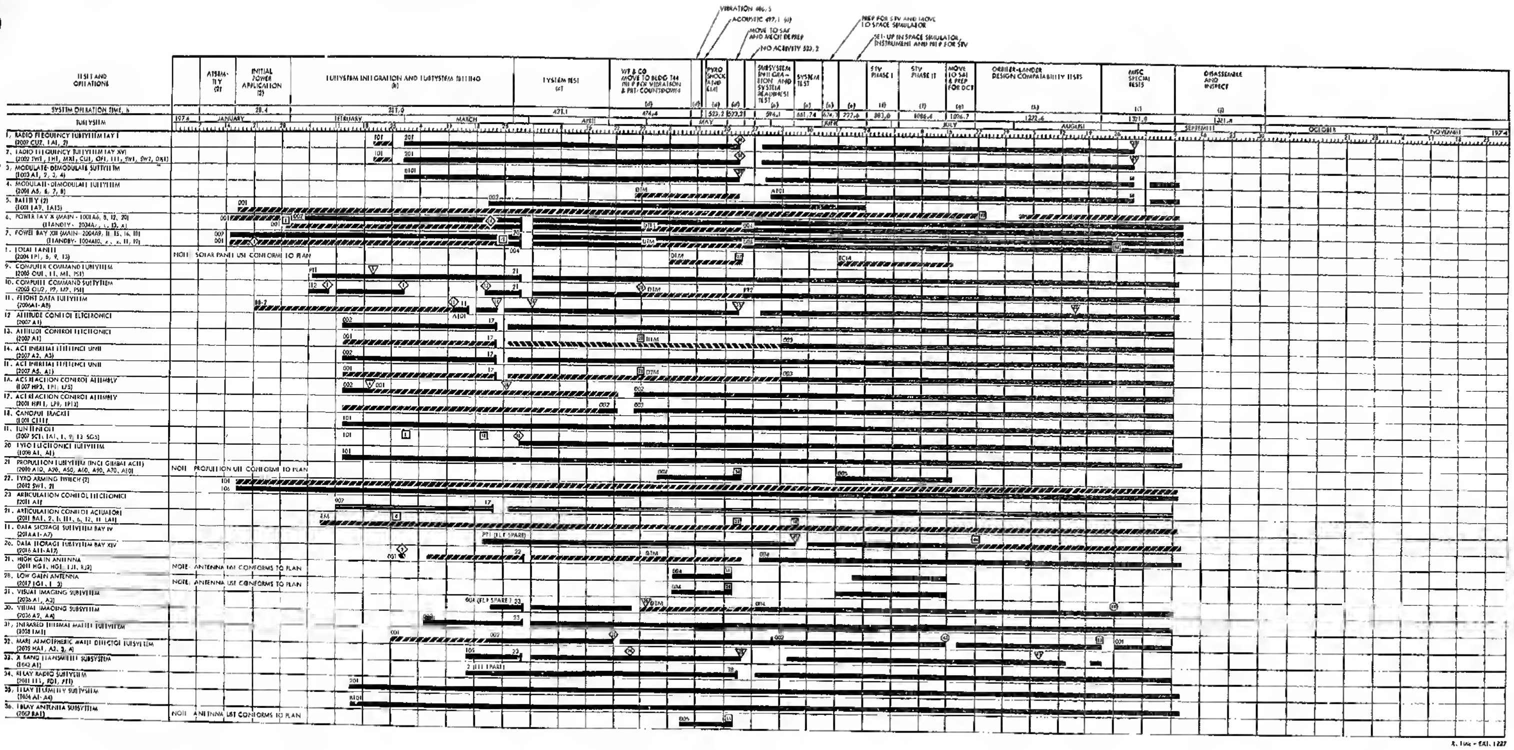
8-26-74 (49) VIS CAMERA "A" S/N 004 RETURNED TO DIVISION TO USE OPTICS AS A COLLIMATOR FOR SPECIAL TESTS. CAMERA "A" WILL NOT BE RE-INSTALLED UNTIL PTO RE-BUILD UP. R/RC 16306.

8-30-74 50 MDS S/N 101 AND B101 SHARE CASE I WITH RFS AND WERE REMOVED WITH RFS. RE-INSTALLED 9-3-74.

8-30-74 (51) PTO RFS BAY I AND BAY XVI S/N 201 REMOVED TO LOW BAY TEST AREA FOR SPECIAL TESTS ON THE VCO SPURIOUS OSC PROBLEM. SUBSEQUENT TO THESE TESTS THE PTO RFS WAS INSTALLED ON VO-2 ON 9-5-74. A RFS WILL NOT BE RE-INSTALLED UNTIL PTO RE-BUILD UP.

NOTE:
CERTAIN HARDWARE, SUCH AS SUN SENSORS, L.P. GAS SYSTEMS AND ACTUATORS ARE SUBJECT TO RELATIVELY FREQUENT REMOVAL & RE-INSTALLATION (R&R), THIS DOCUMENT DOES NOT RECORD SUCH R&Rs. DETAILS ARE DOCUMENTED IN SAF LOG BOOKS.

Figure 7.
PTO Subsystem History
2-15/2-16



VIKING ORBITER 1975
VO-1 S/C HISTORY (PTO)

AS OF [illegible]
NUMBER 1

LEGEND:

XXXXX — ASSEMBLY SERIAL NUMBER; FLIGHT SUBSYSTEM INSTALLED

PROTOTYPE SUBSYSTEM INSTALLED

REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM

P/FR REMOVAL OF SUBSYSTEM FOR

ECI REMOVAL OF SUBSYSTEM FOR

SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND OR CALIBRATION

SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/FR SUMMARY

		S/C
(a)	34001 THRU 34025 WERE WRITTEN DURING ASSEMBLY AND INITIAL POWER APPLICATION	16
(b)	34026 THRU 34147 WERE WRITTEN DURING SUBSYSTEM INTEGRATION AND SUBSYSTEM TESTING	39
(c)	34148 THRU 34204 WERE WRITTEN DURING SYSTEM TEST	26
(d)	34205 THRU 34[illegible] WERE WRITTEN DURING SYSTEM TEST	1
(e)	34[illegible] THRU 34324 WERE WRITTEN DURING SUBSYSTEM INTEGRATION THRU PREP FOR STV	24
(f)	34325 THRU 34363 WERE WRITTEN DURING STV PHASE I AND II	15
(g)	34364 THRU 34[illegible] WERE WRITTEN DURING STV	11
(h)	34370 THRU 34427 WERE WRITTEN DURING OCT	19
(i)	34421 THRU 34447 WERE WRITTEN DURING SPECIAL TESTS	15

SUMMARY OF REMOVALS

1-21-74 (1) POWER BREADBOARD [illegible] BOOSTER REGULATOR OUT OF TOLERANCE. RETURNED TO DIV 1-21-74 AND FOUND LOGIC CKT BOARD, [illegible] WAS PLUGGED IN PROPERLY AND SECURED WITH SCREWS. REINSTALLED 1-13-74 [illegible], R/FC 16425. [illegible] RETURNED TO DIV 1-21-74 FOR EVALUATION. REINSTALLED [illegible] R/FC 16426. BOTH UNITS RETURNED TO DIV [illegible] COLD SOLDER JOINT, [illegible] HAD [illegible] BROKEN AT STANDOFF. BOTH UNITS REINSTALLED 4-27-74. R/FC [illegible] AND R/FC [illegible] REMOVED AGAIN ON 1-29-74 TO [illegible]

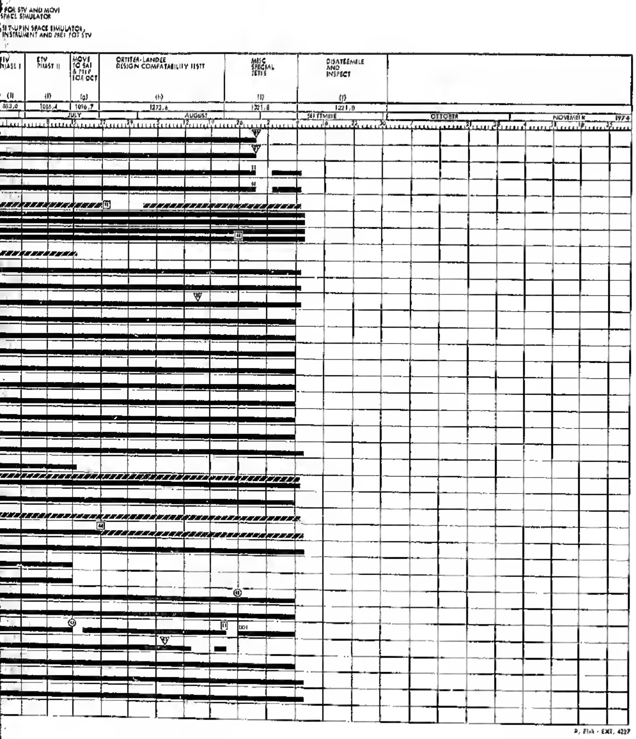
1-27-74 (2) POWER [illegible] MODULE REMOVED, REPLACED WITH [illegible] AND [illegible] ALL [illegible]

2-8-74 (3) CCS HARNESS [illegible] REMOVED. CONNECTOR [illegible] COATED WITH RESIDUE. CONNECTORS CLEANED AND GIVEN [illegible] TION TEST, PASSED TEST, REINSTALLED 2-11-74. P/FR 34026 R/FC 16427

2-26-74 (4) ACE [illegible] LOW PRESSURE MODULE [illegible] REMOVED FOR MODIFICATION TO ALLOW RELOCATION OF MANIFOLD TO MOUNT RADIALLY ALONG THE SOLAR PANEL STAR [illegible]. [illegible] INSTALLED. ECR 17607.

2-21-74 (5) CCS [illegible] REMOVED FOR ECI 17657 WHICH MODIFIED [illegible] TO SWITCH [illegible] DATA TO TRAILING EDGE OF BIT SYNC [illegible] S/N [illegible] (MODIFIED PREVIOUSLY) INSTALLED. REINSTALLED 2-25-74 R/FC 16444

2-27-74 (6) ACTUATOR [illegible] S/N [illegible] REPLACED WITH [illegible] S/N 103 [illegible] INSTALLED 2-[illegible]-74 R/FC 16445.



VIKING ORBITER 1975
VO-1 S/C HISTORY (PTO)

AS OF 9-11-74
NUMBER 3

LEGEND:

XXXXX ——— ASSEMBLY SERIAL NUMBER

PTM SUBSYSTEM INSTALLED

PROTOTYPE SUBSYSTEM INSTALLED

REMOVAL OF SUBSYSTEM FOR STORAGE, PROTECTION, ACCESS TO OTHER SUBSYSTEM

P/FR, REMOVAL OF SUBSYSTEM FOR

ECR, REMOVAL OF SUBSYSTEM FOR

SUBSYSTEM REMOVED FOR INDEPENDENT TEST AND/OR CALIBRATION

SUBSYSTEM REMOVED FOR REASONS OTHER THAN LISTED ABOVE

P/FR SUMMARY

		S/C	OSE
(a)	34001 THRU 34025 WERE WRITTEN DURING ASSEMBLY AND INITIAL POWER APPLICATION	10	15
(b)	34026 THRU 34147 WERE WRITTEN DURING SUBSYSTEM INTEGRATION AND SUBSYSTEM TESTING	59	63
(c)	34148 THRU 34204 WERE WRITTEN DURING SYSTEM TEST	26	31
(d)	34205 THRU 34280 WERE WRITTEN DURING SYSTEM TEST	51	24
(e)	34281 THRU 34324 WERE WRITTEN DURING SUBSYSTEM INTEGRATION THRU PREP FOR TTV	24	19
(f)	34325 THRU 34363 WERE WRITTEN DURING STV PHASE I AND II	25	14
(g)	34364 THRU 34389 WERE WRITTEN DURING SAT	11	15
(h)	34390 THRU 34427 WERE WRITTEN DURING OCT	18	19
(i)	34428 THRU 34447 WERE WRITTEN DURING SPECIAL TESTS	15	5

SUMMARY OF REMOVALS

1-21-74 ⟨1⟩ POWER BREADBOARD 4A10 BOOSTER REGULATOR OUT OF TOLERANCE. RETURNED TO DIV 1-21-74 AND FOUND LOOSE CKT BOARD, BOARD WAS PLUGGED IN PROPERLY AND SECURED WITH SCREWS. REINSTALLED 1-21-74 P/FR 34009, R/RC 16425. PPM 4A17 S/N002 RETURNED TO DIV 1-21-74 FOR EVALUATION. REINSTALLED 1-21-74 R/RC 16426. BOTH UNITS RETURNED TO DIV 1-22-74, BB 4A10 HAD COLD SOLDER JOINT, 4A17 HAD STYCAST BROKEN AT STANDOFF. BOTH UNITS REINSTALLED 4-22-74. R/RC 130074 AND R/RC 130073 4A10BB REMOVED AGAIN ON 1-25-74 TO BONDED STORES.

1-29-74 [2] POWER PPM MODULES REMOVED, REPLACED WITH PTO 4A6, 4A8, 4A12 AND 4A20 ALL S/N002.

2-8-74 ⟨3⟩ CCS HARNESS 9W5/9W55 REMOVED, CONNECTOR PINS COATED WITH RESIDUE. CONNECTORS CLEANED AND GIVEN PIN RETENTION TEST, PASSED TEST, REINSTALLED 2-11-74. P/FR 34036 R/RC 16429.

2-20-74 ▽4 ACS PTO TOW PRESSURE MODULE S/N002 REMOVED FOR MODIFICATION TO ALLOW RELOCATION OF MANIFOLD TO MOUNT RADIALLY ALONG THE SOLAR PANEL SPAR TIE. PRM S/N001 INSTALLED. ECR 17669.

2-21-74 ▽5 CCS SOUT/2 S/NP12 REMOVED FOR ECR 17497 WHICH MODIFIED SOUT/2 TO SWITCH TLM DATA TO TRAILING EDGE OF BIT SYNC. S/N PT-1 (MODIFIED PREVIOUSLY) INSTALLED. REINSTALLED 2-25-74. R/RC 16444

2-27-74 [6] ACTUATOR 8A3 S/N102 THAT REPLACED WITH 8A3 S/N 100 FLT INSTALLED 3-1-74. R/RC 16445.

2-28-74 ⟨7⟩ CCS #2 S/NPT1 REMOVED TO REPAIR LOSS OF COMMAND CAPABILITY. FLEX HARNESS CONNECTOR J8 REPLACED. MODULES M1, OUT, PS1, PI S/N PT1 REMOVED, POWDERY RESIDUE ON CONNECTORS CLEANED AND REINSTALLED 3-20-74 (S/C TESTING CONTINUED WITH OTHER 1/2 OF CCS). P/FR 34079, RR/C 16450.

2-28-74 [8] EM SUNSENSORS 7SC5 S/N101 AND 7SO5 S/N101 REPLACED 2-28-74 WITH PTO SENSORS 7SC5 S/N102 AND 7SO5 S/N102.

2-28-74 ⟨9⟩ DSS PROTO S/N001 REMOVED, 5K IMPEDENCE MEASURED BETWEEN CHASSIS AND SIGNAL GROUND. REWORKED AND RETESTED IN DIV LAB. REINSTALLED 3-6-74 R/RC 16437.

3-12-74 ⟨10⟩ FDS PTO 6A3 S/N101 RETURNED TO DIVISION TO REPLACE 54L00. P/FR 31370 6A4 S/NA101 RETURNED TO DIVISION TO REPLACE 2K RESISTOR SEAT PACK WITH 10K FLAT PACK. UNITS REINSTALLED 3-13-74. R/RC 170022 FDS PTO 6A3 S/NA101 RETURNED TO DIVISION AGAIN ON 3-13-74 TO MODIFY CASE HARNESS AND CHANGE INTERNAL WIRING TO ELIMINATE A GROUND LOOP BETWEEN MDS & LDS ECR 17741, PFR 34074. REINSTALLED 3-14-74. R/RC 16435.

2-16-74 11 CHASSIS BAY VI REMOVED TO ADD CONNECTOR SPACER AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668. REINSTALLED 3-18-74

3-20-74 [12] EM SUN SENSORS 7SA1 S/N101 AND 7SA5 S/N102 REPLACED 3-22-74 WITH PTO SENSORS 7SA1 S/N107 AND 7SA5 S/N111. R/RC 170024.

3-21-74 ⟨13⟩ CCS S/NPT1 REMOVED TO INSPECT CONNECTOR PINS. SLIGHT RESIDUE FOUND ON A FEW PINS, THEY WERE CLEANED AND MODULES REINSTALLED 3-22-74 AFTER MATE AND DEMATE THREE TIMES.

3-22-74 ⟨14⟩ PWR PTO 4A20 S/N002 TO BENCH TEST FOR OVERSTRESS. UNIT WAS OVERLOADED DURING PROP ISOLATION VALVE ACTUATION TEST AT SAF ON 3-18-74, P/FR 34117 NO EVIDENCE OF OVERSTRESS FOUND. REINSTALLED 3/26/74 R/RC 170025

3-23-74 [15] PPM POWER MODULES 4A10, 13, 17, & 11 REPLACED WITH FLIGHT MODULES ALL S/N004 R/RC 170026.

3-23-74 ▽16 FDS 6A4, 6A5, 6A6 S/NA101 FOR TEST AND EVALUATION. 6A4 WAS MODIFIED TO CHANGE S-F PHASE DATA SO MIC CAN PROCESS DATA PROPERLY. ECR 17776. RTPL 54L00 IN 6A6, P/FR 34114 REINSTALLED 3-25-74 R/RC 170031.

3-23-74 17 CHASSIS BAY V REMOVED TO ADD CONNECTOR SPACERS AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668. REINSTALLED 3-26-74.

3-26-74 ▽18 ACS PTO RPM S/N002 FOR MODIFICATION TO CROSS LST HP HELIUM WITH ACS N_2 GAS SYSTEM, ECR 17734. RPM S/N001 INSTALLED. REINSTALLED 4-19-74 R/RC 16467.

3-29-74 ⟨19⟩ SUN SENSOR 7SC3 S/N102 RETURNED TO DIV FOR REWORK OF LOOSE INSERT. REINSTALLED 4-1-74. P/FR 34068 R/RC 170034 REMOVED AGAIN 4-3-74 TO FIX BATTING IN THE LIGHT HOOD. REINSTALLED 4-4-74 R/RC 170047

3-29-74 20 CHASSIS BAY X AND XII REMOVED TO CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17668. REINSTALLED 4-1-74.

3-29-74 21 CHASSIS BAY II REMOVED TO ADD CONNECTOR SPACERS AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668 REINSTALLED 4-1-74.

3-29-74 22 CHASSIS BAY XIV REMOVED TO CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17668. REINSTALLED 4-1-74.

3-29-74 23 CHASSIS BAY VIII REMOVED TO ADD CONNECTOR SPACERS AND CHANGE FLAT MOUNTING SHIMS TO WRAP-AROUND TYPE PER ECR 17666 & 17668 REINSTALLED 4-1-74

4-1-74 ▽24 FDS 6A3 & 6A6 S/NA101 RETURNED TO DIV FOR REWORK AND MODIFICATION. 6A3 REWORK OF PREVIOUS ECR 17741 MOD, P/FR 31372 6A6 TO MODIFY TO PROVIDE PROPER CODE FOR MAWD CONTROL COMMAND CC39D ECR 17779 REINSTALLED 4-2-74 R/RC 170041.

4-22-74 ⟨25⟩ IRIS RETURNED TO DIVISION FOR REPAIR OF LOOSE CONNECTOR STUD AND TO RE-CHARGE DETECTORS, RE-INSTALLED 4-24-74, P/FR 34131, R/RC 16475.

4-26-74 ⟨26⟩ MAWD HEAD REMOVED TO RE-ROUTE CABLE TO ALLOW PROPER MATING OF CONNECTOR. RE-INSTALLED 4-27-74. P/FR 34207.

4-29-74 [27] ACE & IRU S/N001 (PPM) MODULES NOT QUALIFIED FOR INSTALLATION, REPLACED WITH OTM MODULES. OTM MODULES REPLACED WITH FLIGHT SPARE S/N003 ON 6-3-74.

4-30-74 ⟨28⟩ CCT S/N PE2 MODULES M1 AND P1 FOR PROCESSOR ERRORS, FOUND AND REPAIRED INCORRECTLY ROUTED HAYWIRE IN P1, ALSO REPLACED ASSOCIATED IC, M1 WAS NOT TOUCHED, BOTH UNITS INSPECTED FOR CORROSION (OK) AND CLEANING OF CONNECTORS, P/FR 34202, 203, 204 & 213. REINSTALLED 5-24-74, R/RC 16471.

5-1-74 ▽29 VIS SN006 TO CHANGE BIAS RESISTORS TO REDUCE LINE SWELL DISTORTION PER ECR 17820, RE-INSTALLED 5-28-74, R/RC 170172.

5-23-74 ⟨30⟩ RFS SWTA-2 CONTROL UNIT FAILURE ON 5-8-74, P/FR 34246, VIBRATION AND SUBSEQUENT TESTS CONTINUED USING SWTA-1. CONTROL UNIT REPAIRED AND SWTA-2 REPLACED, RE-INSTALLED 5-29-74, R/RC 170183.

5-23-74 ▽31 MDS S/N B101 (PTO) TO INCORPORATE ECRs 17690, 17778, & 17895 MODIFICATIONS TO ELIMINATE RACE CONDITIONS IN CDU LOGIC, TO INVERT POLARITY OF PLAYBACK DATA BETWEEN DSS & MDS, AND TO ELIMINATE HIGH FREQUENCY OSCILLATION ON TLM AT RFS INTERFACE. RE-INSTALLED 5-30-74. R/RC 16514, 16518 AND 16520.

5-23-74 [32] SOLAR PANELS (OTM) REMOVED, NO FURTHER TESTS ON PTO REQUIRED. SPECIAL STUB PANELS FOR TCM WILL BE INSTALLED FOR STV TEST.

5-23-74 ▽33 FDS S/N A101 PTO TO INCORPORATE ECRs 17777, 17859, 17776, 17844 & 17848 FOR MODIFICATION OF 7A1 TO REMOVE SINGLE POINT FAILURE IN VIS INTERFACE, AND TO CHANGE VALUE OF PICK-UP RESISTOR, 4A2 TO MODIFY IRIS INTERFACE AND CORRECT IRIS SEQUENCE, 7A1 & 7A2 TO MODIFY VIS INTERFACE AND TO INSTALL NETWORK IN VIS PROCESSOR, RE-INSTALLED 5-29-74, R/RC 11114.

5-23-74 [34] PROPULSION SYSTEM S/N P104 REMOVED, NO FURTHER REQUIREMENT, SLAVE SYSTEM S/N005 INSTALLED 6-17-74 FOR TTV.

5-23-74 [35] SOLAR ENERGY CONTROLLERS (SEC) REMOVED AND STORED FOR PROTECTION, NO FURTHER REQUIREMENT UNTIL STV TEST, SEC ACTUATORS 1, 4, 6, 12 AND 14 ALSO REMOVED, RE-INSTALLED ON TEST BRACKETS 5-29-74, SECs AND SEC ACTUATORS RE-INSTALLED ON PTO 6-15-74 FOR STV TEST

5-23-74 [36] LOW AND HIGH GAIN ANTENNAS REMOVED, NOT REQUIRED UNTIL TTV TEST.

5-21-74 [37] RELAY ANTENNA REMOVED, NOT REQUIRED FOR STV.

5-23-74 38 X1X S/N 121 FOR ACCESS TO COAX CABLING IN STRUCTURE IN AREA OF BAY 1, RE-INSTALLED 5-28-74.

5-24-74 ▽39 MAWD S/N 105 (PTO) FOR ECR 17984, MODIFICATION TO THE CALIBRATION LAMP DRIVE CIRCUIT TO DECOUPLE THE LAMP DRIVE CURRENT FROM THE +12 VOLT SUPPLY, RE-INSTALLED 6-5-74, R/RC 11517.

6-1-74 [40] ACTUATORS CONFIGURATION FOR STV - 13A1 S/N 104, 13A2 S/N 103, 13A3 S/N001, 13A4 S/N S/N001.

6-7-74 ▽41 DSS S/N PT1 MODULES A3 AND A7 RETURNED TO DIVISION TO MODIFY DATA STROBE AND ENABLE CIRCUITRY PER ECR 17830 FOR NOISE IMMUNIZATION. RE-INSTALLED 6-10-74, R/RC 16464

7-15-74 ⟨42⟩ IRIM S/N 003 RETURNED TO VENDOR FOR RACKET OF DEFICIENT AND REFURBISHMENT. REINSTALLED 7-19-74 R/RC 16375.

7-22-74 ⟨43⟩ TEST BATTERY REMOVED TO INSTALL ON VO-2 REINSTALLED 8-7-74

7-22-74 [44] DTT FLIGHT SPARE SET PT1 REMOVED AND THE PROTO DSS S/N 001 INSTALLED

8-1-74 ▽45 MAWD HEAD ASSEMBLY S/N 105 RETURNED TO DIVISION FOR NEW LATCH DESIGN PER ECR 83878 AND 83891 ELECTRONICS MODULES 8-14-74 TO CHECK OUT NEW LATCH DESIGN. IN ADDITION TWO RESISTORS WERE REPLACED PER ECR 83988 AND 83987. RE-INSTALLED 8-20-74 R/RC 170501

8-15-74 ▽46 FDS MODULE 6A3 S/N A101 RETURNED TO DIVISION FOR MODIFICATION TO REDUCE NOISE DUE TO VIS PLAYBACK DATA. S/N A102 INSTALLED S/N A101 RE-INSTALLED 8-17-74, R/RC 170622

8-23-74 [47] IRTM S/N 002 REMOVED TO RE-INSTALL PTO UNIT S/N 001 WHICH HAD BEEN RETURNED TO VENDOR FOR ENGINEERING EVALUATION. DETECTORS WERE BACKFILLED PRIOR TO RE-DELIVERY S/N 001 RE-INSTALLED 8-26-74. R/RC 16455

8-26-74 [48] PWR 4A10 S/N 003 (BOOSTER REGULATOR) REMOVED AND THE BB 4A10 INSTALLED TO USE FOR SPECIAL 20% VOLTAGE OVERLOAD TEST. FOLLOWING THE TEST THE PTO 4A10 S/N 002 AND THE 4A17 S/N 003 WERE REMOVED 8-30-74 AND RETURNED TO VENDOR FOR EVALUATION. THE 4A10 FLM S/N 001 WAS INSTALLED. THREE SHORTED ZENER DIODES WERE REPLACED IN THE 4A17 S/N 003. BOTH UNITS RETESTED AND RETURNED TO JPL. ALL ORIGINAL MODULES 4A10 S/N 003, 4A11 S/N 002 AND 4A17 S/N 003 RE-INSTALLED 9-6-74

8-26-74 ⟨49⟩ VIS CAMERA "A" S/N 004 RETURNED TO DIVISION TO USE OPTICS AT A COLLIMATOR FOR SPECIAL TESTS. CAMERA "A" WILL NOT BE RE-INSTALLED UNTIL PTO RE-BUILD UP. R/RC 16306.

8-30-74 50 MDS S/N 101 AND BLOCK SHALL CABLE WITH RFS AND WERE REMOVED WITH RFT. RE-INSTALLED 9-3-74.

8-30-74 ▽51 TWO RFS BAY I AND BAY XVI S/N 271 REMOVED TO LOW BAY TEST AREA FOR SPECIAL TESTS ON THE VCO SPURIOUS OSC PROBLEM. SUBSEQUENT TO THESE TESTS THE PTO RFS WAS INSTALLED ON VO-2 ON 9-5-74. A RFS WILL NOT BE RE-INSTALLED UNTIL PTO RE-BUILD UP.

NOTE: CERTAIN HARDWARE, SUCH AS SUN SENSORS, I.E. GAS SYSTEMS AND ACTUATORS ARE SUBJECT TO RELIABILITY REQUIRED REMOVAL & REINSTALLATION (RRR), THIS DOCUMENT DOES NOT RECORD SUCH RRRs. DETAILS ARE DOCUMENTED IN THE LOG BOOKS.

Figure 7.
PTO Subsystem History

SECTION III
VIKING ORBITER 1 TEST RESULTS

A. SYSTEM TEST COMPLEX EQUIPMENT ASSEMBLY AND TEST

This operation marked the physical beginning of the orbiter system test program. It began in Jan. 2, 1974 with the initial System Test Complex (STC) cable installation at STC No. 1 and delivery of the first system test stand to the SAF. The second system test stand was delivered two days later, and both stands were readied to support orbiter tests.

Testing of the STC included voltage checks, open-circuit tests, and operational verification of all signals (JPL Procedure VO75 402). These tests and associated troubleshooting were performed in parallel with orbiter assembly and testing but, in each case, prior to interfacing to flight hardware. The STC/MTCS interface was tested per JPL Procedure VO75 404.

B. ORBITER INSPECTION AND ASSEMBLY

As individual orbiter hardware was received, and before it was installed or tested, it was inspected and certified by SAF Quality Assurance (QA) per JPL Procedures QAP 60.1 through 60.12. JPL Procedure VO75 100 controlled the assembly of the orbiter as parts became available.

The orbiter cable installation basically consisted of a solar energy controller (SEC) harness on the aft end of the orbiter, an upper ring harness, and interconnecting cables to each bay.

The electronics assemblies were installed in as logical a sequence as possible as they became available, either as breadboards or prototypes. Pyrotechnic equipment, scan platform, science instruments, guidance sensors, and mechanical devices were installed and individually exercised as described below in preparation for system testing. Not installed at this time were solar panels, radio antennas, propulsion subsystem, and reaction control assemblies.

Instead, solar panel and propulsion simulators were used, and the antenna outputs were hard-wired into the support equipment.

C. INITIAL POWER APPLICATION

This operation was carried out as soon as all harnesses and the power subsystem were installed. It included a complete power subsystem check for proper power distribution. All connectors were open-circuited, tested to ensure that the correct voltage appeared at the proper pins, and then a simulated subsystem dummy load was applied to verify harness resistance. Various power parameters were also verified per JPL Procedure VO75 204. Initial orbiter external power turn-on occurred on Jan. 18, 1974.

D. SUBSYSTEM INTERFACE VERIFICATION AND SYSTEM INTEGRATION

As each subsystem was installed, a check was made of its interface impedances and grounds. Following initial power turn-on, subsystem interfaces were checked as the subsystems were delivered and installed. This was done in order of increasing complexity, progressing from simple loops of two subsystems only, to more complex multisubsystem loops. The lander interface duplicator substituted for the VLC during this testing.

After basic integration of the PTO with the STC to the level of system test capability, each subsystem was tested per its own JPL Procedure (see Table 1). Because of hardware availability problems and the inability to exercise all VO operating modes early in the testing phase, elements of the test procedures were exercised out of order. As new assemblies were substituted for prototypes (see Figure 8), applicable portions of the integration procedures were repeated. All subsystem integration procedures were completed by the end of this phase.

The following text covers the significant problems encountered during the verification/integration phase. For convenience, the problems are considered to be either of a general nature, PWR related, FDS related, CCS related, or DSS related, although they may have had a direct effect on other subsystems.

Table 1. VO-1 Subsystem Initial Integrations

Subsystem	Start Date	JPL Procedure
Power	1/14/74	VO75 204
Flight Data	1/24/74	VO75 206
Computer Command	2/4/74	VO75 205
Articulation Control	2/11/74	VO75 215
Attitude Control	2/13/74	VO75 207
Relay Radio	2/20/74	VO75 252
Relay Telemetry	2/23/74	VO75 256
Propulsion Simulator	2/25/74	VO75 210
Infrared Thermal Mapper	2/26/74	VO75 238
Radio Frequency	3/2/74	VO75 202
Modulation-Demodulation	3/5/74	VO75 203
Data Storage	3/6/74	VO75 216
Pyrotechnics	3/9/74	VO75 208
Visual Imaging	3/14/74	VO75 236
Mars Atmospheric Water Detector	3/15/74	VO75 239
X-Band Transmitter	3/19/74	VO75 242

1. General P/FRs

A clamp which was mounted on the PTO in a different location than on the orbiter mock-up and orbiter drawings caused some upper ring harness cables to be too short (P/FR 34003). The mock-up and drawings were changed to reflect the preferred cable routing.

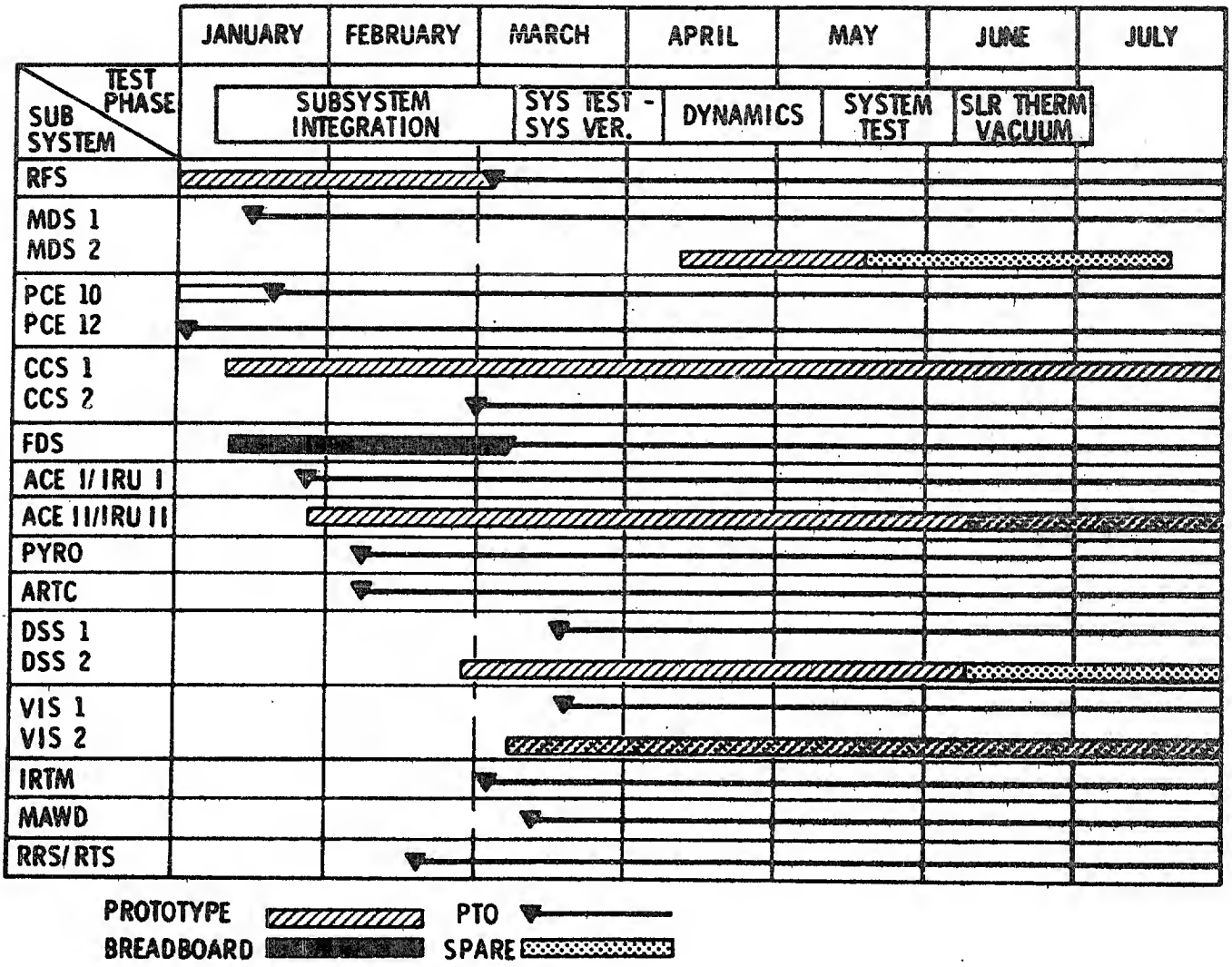


Figure 8. PTO Subsystem Content vs. Time

The index pins in the separation connectors of the upper ring harness were 180° out of phase with respect to the STC cables (P/FR 34005). This was caused by an erroneous pre-release installation drawing.

Chassis were installed and removed many times from the orbiter bus. One such operation exposed a shim which had partially peeled loose and folded over the remaining portion of the shim (P/FR 34014). The shim was redesigned to create an adequate bonding surface (ECR 17668).

2. PWR Related P/FRs

With a dummy load applied, the initial power turn-on to the power subsystem produced inverter alarms, booster-regulator (B/R) alarms, and external power supply current limiting (P/FR 34009). Power was shut off after 37 seconds. Visual inspection of the booster-regulator showed that a circuit board was cocked in its connector. The loose board was secured in place with screws, and the initial power application procedure was completed without further incident.

3. FDS Related P/FRs

Some P/FRs, especially during the early part of the orbiter test program, were generated due to anomalies which occurred once and never repeated. Where the cause of the problems was unknown and the anomaly could not be recreated, and analysis did not uncover a probable cause, the P/FR was closed without design changes or other action.

A number of one-time occurrences interrupted the FDS integration while the breadboard was used but did not appear during retesting or after the PTO FDS was used:

(1) It took two SE commands to get through to the FDS (P/FR 34017). Review of the log data did not yield a plausible explanation.
(2) During ARTC testing, no data number was measured on a tree switch (P/FR 34036). Observation at the FDS-SE implied noise. A loose connector was suspected.
(3) A similar problem occurred at a different tree switch position, with similar results (P/FR 34039).
(4) When trying to command a change in the FDS engineering format through the CCS-2 some time after a memory address command, the last memory address command was lost from FDS memory (P/FR 34056). The cause could not be traced.
(5) During the FDS/MDS interface integration, MDS status bit 3 and TMU-A status bits 1, 2, and 3 did not change as expected (P/FR 34078). A loose connector was suspected.

(6) The FDS 32 kHz reference clock caused anomalies in the DTR (P/FR 34086). The problem was only partially relieved by removals of breakout boxes (BOBs) between the FDS and DTR. The special adapter which joined the FDS breadboard to the upper ring harness materially from flight cables in its treatment of DSS circuits.

While performing continuity tests on the scan harness, an open circuit was measured (P/FR 34057) between the FDS and IRTM temperature transducer. Wiggling the harness eliminated the open circuit and the problem never repeated. Verifying the problem would have interrupted SAF testing, so it was decided to retest the harness at another time prior to flight. The IRTM temperature measurement would be lost if this problem recurred in flight.

A broken wire in the data storage subsystem caused a 5-volt pull-up voltage to be missing in the FDS to DTR-B interface (P/FR 34089). The wire, which was an unpotted test harness with no strain relief, was repaired.

All capacitor banks as monitored by the FDS showed variations of ±5DN (nominal 71 DN) instead of an expected steady voltage (P/FR 34091). The variations were primarily attributed to 60 Hz noise caused by two preset counters in the pyro system test set. Some noise reduction was achieved by reversing the ac power plug of one preset counter relative to the other counter. This investigation uncovered a dc offset error voltage in the SE which was also corrected (P/FR 32032).

The FDS block decoder did not lock on spacecraft data due to noise in the FDS/MDS interface (P/FR 34082). The noise seemed to come from several sources: 1) an unshielded cable, 2) a common return line to MDS, and 3) a FDS/MDS ground loop (P/FR 34094). The interface design was changed to correct these three flaws (ECR 17741).

During MAWD functional tests, it was noted that the FDS control word did not contain the automatic intensity calibrate signal, or the forced intensity calibrate signal when commanded by the CCS (P/FR 34114). The problem was traced to a defective IC.

4. CCS Related P/FRs

Initial attempts to integrate the CCS failed due to the 'D' connector pins on the modules being coated with solder flux residue (P/FR 34026). The cleaning procedure was changed and the CCS modules and harness underwent complete cleaning.

The CCS status word did not agree with the printout and display at the FDS-SE because a design error had the CCS and FDS handling telemetry data at different points on the bit sync (P/FR 34032). The CCS was altered to shift telemetry data at the same time that FDS sampled the data (ECR 17657).

During a special test to integrate a modified CCS output unit to the system, a command did not register at the breakout box of CCS-SE (P/FR 34048). The problem disappeared after the output unit had been moved to another location, and a loose or dirty connector is suspected.

Integration of the second half of the CCS produced erratic operation (P/FR 34069). The CCS-1 connector pins were found to be contaminated with white solder flux and black burned spots on the surface. The black areas seemed to have occurred at SAF when the sockets were mated, but the cause was a mystery. The CCS circuitry could not put out current magnitudes required to burn pins. The white areas were cleaned as in P/FR 34026 and the black pins were replaced.

Further solder flux residue was discovered on some CCS Processor A pins: accelerometer pulses return, RFS input return, and two other pins (P/FR 34118). This resulted in the coordinating P/FR which gave a new pin cleaning procedure used in P/FRs 31119, 34026, 34048, and 34069.

CCS Processor A did not issue a DC 52A command as required (P/FR 34124). The cause was unknown and the failure never recurred. No corrective action was taken with the hardware, but the software was modified to provide more information for analysis should the problem reappear.

5. DSS Related P/FRs

TMU-A stopped modulating the carrier frequency with data from DTR-B when DTR-A was turned off (P/FR 34129). A design oversight, whereby the off-power DTR blocked the active DTR from reaching the TMU, was corrected by removing inversion stages within the DSS and MDS (ECR 17778).

The DSS exhibited four command response failures: two during subsystem integration (P/FRs 34126 and 35139), one during initial system testing (P/FR 34182), and one during system test one (P/FR 34295). These failures were thought to be in the DTR control logic. Investigation and special testing resulted in the addition of an R-C filter to the 2.4 kHz clock line (P/FR 32624 and ECR 17830). This corrected a marginal ringing situation and appeared to solve the reported failures. Another sensitive area in the DSS design was discovered during the investigation, but it was decided to make no changes in this area unless further problems occurred.

E. INITIAL SYSTEM TEST AND SYSTEM VERIFICATION TESTS

The first system readiness test (SRT), as a prelude to the first system test, began March 27, 1974, per JPL Procedure VO75 301. The SRT verified the major orbiter system functions and the system support equipment configuration (direct access connections and external stimuli, visual imaging subsystem collimator alignment, attitude control subsystem light hoods, gas jet pressure switches, etc.). Power profile and benchmark data were gathered for comparison with like data from future SRTs.

During the SRT, 37V noise spikes were found on the 30 VDC converter output after pitch and yaw preaim data was loaded into the ACEs (P/FR 34145). The source of the noise was the switching of a thrust-vector-control actuator driver transistor. Redundant zener diodes in series with two-amp fuses were placed across the 30 VDC positive and return (ECR 17859). This solution limited the transients to a 33 to 47V range and adequately protected all systems.

Also during the SRT, the ACS power change-over level input to the CCS was not recognized (P/FR 34189). The software was redesigned to recognize that the power change-over level was negative logic (ECR 17805).

On-net review of the system test procedure (JPL Procedure VO75 300) was conducted April 4, 1974 as the first step in performing the test.

In the course of the system test, three problems relating to the DTR tape positioning appeared:

(1) A CCS command to automatically position the DTR resulted in the DTR stopping early (P/FR 34168). The failure was dealt with by altering the software (ECRs 17810 and 17842).
(2) The DTR positioning function was not properly initialized by the CCS during the prelaunch verification sequence (P/FR 34169). This was corrected by modifying the CCS reset function (ECR 17805).
(3) Two illegal modes existed for the DSS which might have been obtained after implementation of the CCSs tape positioning sequence (P/FR 34172). This possibility was eliminated through software modification (ECR 17805).

VIS A&B pictures showed line disturbances due to the sensitivity of the vidicon G4 mesh to the mechanical shock generated by the adjacent camera shutter and filter wheel (P/FR 34185). The flight VIS vidicon was reworked to be less sensitive to shock-induced mesh vibration, the shutter mounting was redesigned to reduce the shock transmission to the adjacent camera (ECR 17910), and the stepping of VIS filter wheels was programmed so as not to interfere with critical flight picture sequences.

The pitch and yaw gimbal actuators became unstable and oscillated in an attempt to converge on the commanded position (P/FR 34208). Excessive actuator backlash was found to be caused by the wearing in of the Beaver ball screws. The gimbal actuators in question were reworked by replacing the Beaver ball screw with one manufactured by Kidde.

Six system-level verification tests were performed to verify correct subsystem calibration and alignment before completion of the initial system test which preceded environmental testing. The six tests were:

(1) Orbiter block tests validated flight software as to proper initial conditions, constraints, final state, and response.
(2) Power profile and transient measurements were taken off each subsystem to verify tolerances.
(3) Solar panel mechanical deployment was tested as close as possible to flight configuration to verify proper functioning and to compare with DTM test results.
(4) Telemetry calibration was verified as to agreement with data sheets, proper output, and FDS programmability of all engineering telemetry measurements.
(5) Science instrument alignment with respect to other instruments and with respect to the scan platform coordinate system was accomplished by use of a collimator and mirrors.
(6) Articulation control subsystem calibration and mechanical interface verification was done with measurements of the mechanical alignment offset of the various articulation control actuators.

No major problems developed during this phase of testing.

F. WEIGHT AND CENTER-OF-GRAVITY MEASUREMENT

Mechanical buildup of the PTO for the weight and center-of-gravity measurement began on April 27, 1974 per JPL Procedure VO75-100 and continued to May 6, 1974, at which date the measurement was performed per JPL Procedure VO75 101. The measured weight was within 10 pounds of predicted weight.

The clock actuator of the articulation control subsystem (ARTC) was driven against the stop and the drive box would not reverse (P/FR 34218). The output adapter on the actuator had been installed upside down and, once the electrical

zero stop was passed, the drive box safety circuitry prevented driving out of this region. With the output adapter installed properly and the actuator positioned, no further electrical repositioning was required. However, the drive arm of the clock actuator was found to have been installed in a reversed position due to the installation drawing being wrong (P/FR 34226). The drawing was revised and the installation procedure clarified.

One of the VIS hood assembly bolts could not be torqued as required due to turning of the boss insert (P/FR 34221). Torque overload on the insert was caused by an overlong screw. The insert was drilled out and replaced, and the installation drawing was changed to require screws of proper length.

G. VIBRATION, ACOUSTICS, AND LAUNCH COMPLEX TESTS

Preparation for the environment (vibration, acoustics, electromagnetic compatibility, and pyrotechnic shock) and launch complex tests began May 7, 1974. The PTO was moved to Building 144 and installed on the vibration machine per JPL Procedures VO75 102 and VO75 107. Following completion of tests on the orbiter, another series of vibration tests with a lander mass simulator installed on the orbiter was carried out. The orbiter was returned to the transporter and rolled into the acoustics test chamber for acoustics, EMC, and pyro shock tests. The vibration and acoustics tests were completed per JPL Procedure VO75 303 on May 15, 1974. The launch complex tests were performed in conjunction with the other tests in this phase per JPL Procedures VO75 112 and VO75 308. This test configuration was identical to the launch pad configuration, and the Launch Complex Equipment Trailer (LCET) was used to support all tests in this phase.

Traveling wave tube amplifier (TWTA) No. 2 in the RFS did not turn on after warmup time elapsed (P/FR 34246). A mechanical short due to tolerance buildups in the regulator caused component failure in the regulator but did no damage to other assemblies. The regulator height was increased to prevent shorting. TWTA No. 1 operated normally.

Three problems with the mounting of spacecraft blankets were observed:

(1) The cutout in the propulsion blanket rode hard on the Viking-spacecraft-adapter mounting feet in four places which could tear the blanket at Orbiter/VSCA separation (P/FR 34241). The footprint used for the VSCA cutout was undersize by about 0.25-inch. The propulsion blankets were reworked prior to solar thermal vacuum testing (ECR 17805).

(2) The thermal blanket or the bay 5 outrigger moved, causing the sungate cutout in the blanket to shift (P/FR 34263). An additional tie was added to retain the blanket.

(3) The scan platform thermal blanket was held in place by string ties in such a way that if one tie failed or was dislocated, the blanket would be lost (P/FR 34264). Four screws were added to support the blanket.

The vibration and acoustic tests caused the performance of some subsystems to vary during the course of the tests. However, these subsystems returned to normal operation after the testing, and analysis indicated that no action was required. For example, the RFS receiver local oscillator drive decreased by about 0.3 dB during vibration testing (P/FR 34267). Variations of this type have been observed in this kind of RFS on prior programs and are not considered significant. Another example was the DSS, which was unable to maintain bit sync lock on the recorded data during vibration and acoustic testing (P/FR 34269). The problem was caused by tape speed variations of ±20% in the DTR. This is typical performance of the DTR during vibration.

H. ELECTROMAGNETIC COMPATIBILITY AND PYROTECHNICS SHOCK TESTS

Electromagnetic compatibility (EMC) and pyrotechnic tests were performed immediately after the acoustic test in Building 144 per JPL Procedures VO75 312, VO75 108, and VO75 304. This phase of testing was completed May 20, 1974 and the PTO was moved back to SAF. At the conclusion of the

environment tests the PTO appeared in good condition with the exception of the RFS TWTA failure (described in Section G) which was not environment induced. The test configuration for ACS, CCS, and MDS included only the PTO half of each subsystem, with the other half reserved as flight spare and not installed for the TA tests. The MAWD was not powered at all, as is normal for pre-launch configuration. Performance of the LCET equipment and remote control elements for on-pad activity was satisfactory and trouble free. The orbiter system had 523 running hours on it. Significant problems occurring during this phase are described below.

During the electromagnetic interference (EMI) test, the TLM channels for PROP tank pressure decreased when the lander relay radio simulation source was turned on (P/FR 34270). The problem was traced to pressure transducers which were sensitive to 381 MHz. Special tests revealed no damage to the transducers and, as data from these channels is not used during operation of the VLC relay radio, the only action taken was further monitoring of the problem.

The quantitative leak test (JPL Procedure VO75 116) exposed leaks in the reaction-control-assembly high-pressure-module using a leak-detecting liquid solution 'SNOOP' (P/FRs 34276 and 34277). The fill-valve handle cavity and isolation valve stem in bay 11 were leaky. Both valve assemblies were disassembled and microscopically inspected. Small metallic particles were found on the O-ring sealing surfaces but no damage was evident. After ultrasonic cleaning, reassembly (the fill valve with a new O-ring) and tests, no leaks occurred. The bay 3 fill-valve handle cavity had a torn silicon-rubber O-ring. As a result of review with the hardware vendor, more specific instructions were incorporated and leak testing was required six times before launch.

I. SYSTEM TEST BEFORE SPACE SIMULATION

Much reconfiguration had to be done before the next system test and the space simulator run following. All development-test-model and prototype hardware was removed and replaced: VIS A, CCS B, CDU A, TMU B, ACS B,

DSS B, PWR, and PROP. Several subsystems required rework: FDS, RFS, MDS, and MAWD. Six new subsystems were integrated during this phase: MDS, ACS, IRTM, PWR, DSS, and PROP. The actual system test was initiated June 6, 1974.

Orbiter performance was excellent. A complete functionally redundant system was assembled. All new and reworked hardware performed well. The PTO had run about 670 hours at the conclusion of system testing.

Random pulses generated from the DSS tach amplifier during ready mode caused an offset in the tape position indicators in both the support equipment and the onboard CCS, and a number of P/FRs resulted: 34105, 34201, 34287, 34374, and 34429. Redesign of the tach amplifier gave some improvement, but complete solution required gating off the tach clock during the ready mode (ECR 17958).

The IRTM 'D' detector channels changed intermittently (P/FR 34298). The problem was traced to a design flaw in the analog-to-pulse-width converter where a signal return and a power ground were not tied together. Flight units were reworked (ECR 18034).

The DTR was missing pulses while running down after operating at the VIS rate (P/FR 34302). The pulses were for tape increment/decrement to CCS and for Tach Clock Monitor to DSS-SE. This failure was related to an earlier problem which occurred during bench testing, when the DTR failed to obtain tape speed control (servo control lock) at 16 kb during transition from slew VIS to slew 16 kb (P/FR 32750). The problem originated in the TMEM, where data signal modulation of the DST tach signal caused the loss of tape position information. Redesign of the tach amp greenstick, so that higher slew rate amplifiers are used, solved the problems. Redesign of the TMEM to do away with the modulating source was considered to be too difficult.

Three related FDS memory failures occurred during PTO testing (P/FRs 34307, 34406, 34415). Investigation uncovered a FDS design deficiency whereby memory address commands were occasionally rejected during a memory block load. ECR 18100 corrected the FDS design.

J. SPACE SIMULATION TEST

The PTO was moved to Building 150 for the space simulation test on June 17, 1974. A number of operations were performed during the 29 days that the PTO was in the space simulator:

(1) A detailed system test demonstrated functional performance while operating in a simulated space environment. All elements which passed the previous system test also passed this one.
(2) Solar vacuum tests (SVT) per JPL Procedure VO75 302 verified the temperature control design, and no thermal control problems were encountered in normal flight-acceptance (FA) and type-approval (TA) thermal modes. However, the occultation after TA cold was not performed because some subsystems were at their allowable lower limits. The system was cooler than the temperature control model, indicating lower total power dissipation. The high-gain antenna was configured for the near-earth condition and ran hot as expected (near 200°F).
(3) Parallel testing for compatibility with CTA-21, the DSN compatibility test area, was about 90 percent complete when the test ended.

At the conclusion of space simulator testing, the PTO had run over 1086 hours, of which 380 hours were in vacuum. Significant problems occurring during this phase are described below.

Battery No. 1 cells were giving unusual readings at the power support equipment (P/FRs 34331 and 34333). Two cell monitor fuses were found to be blown, and a suspect scanner card was removed from the SE. Many hours of testing could find nothing wrong with the card but, since a spare card performed correctly, the suspect card was retained for possible future testing.

Solar energy controller (SEC) 4 reached a mechanical stop before arriving at its electrical null, preventing the slew from terminating (P/FR 34341). Buildup of mechanical tolerances probably caused the problem. The software was changed to restrict the SEC from motion to either extreme which prevents stalling against the mechanical stop.

DSS DTR-A performance during a TA cold test degraded enough to prevent data recovery (P/FR 34344). The servo loop would not maintain tach lock due to very high 30 Hz component in the loop. The DTR gradually recovered after two hours of operations as the temperature rose about 3°C. Analysis revealed that the transport damper was not damping the normal transport resonance at both high and low temperatures due to variations of the spring and damping constants of the rubber damping material over temperature. To assure an adequate temperature margin, the preferred cruise temperature was changed to 60/80°F and, at near 50°F, a warmup time of up to five hours was specified (ECR 17793).

During phase 2 STV, the MAWD optics heater was on 85 percent of its duty cycle, too high a percentage to provide adequate heater power margin for the platform in colder cone/clock positions (P/FR 34351). The duty cycle was improved to 60 to 63 percent by increasing the heater on the MAWD side of the scan platform structure from 2 watts to 4 watts (ECR 17946).

K. PASADENA SPACECRAFT OPERATIONS

With the end of space simulator testing, the PTO was moved back to SAF on July 16, 1974. The next two months were a period of various operations including completion of the CTA-21 compatibility test, PTO/lander hardware integration and compatibility tests (JPL Procedure VO75 415). The orbiter system generally performed properly and in specification for all phases of this test series. Running time of the PTO increased to 1323 hours.

The original test plan had the spacecraft test lander in SAF for integration of orbiter, lander, and DSN via CTA-21. Schedule problems precluded lander tests at JPL, and a substitute test series using the orbiter and all lander interface subsystems was conducted instead.

All orbiter and lander functions related to their electrical interface, the DSN interfaces, and the VMCCC interfaces were verified. Compatibility with lander RTGs was verified with some margin. All functional interfaces between the orbiter and lander were verified to be in specification except as noted in the problem below.

The VO/VLC command modulation was not in specification (P/FRs 34381 and 34395). Subsequent analysis showed that false acquisitions caused by the modulation were inherent in the system, predictable, and avoidable with judicious selection of flight operating conditions. Also, errors were found in the test procedure.

L. FINAL PTO SPECIAL TESTS

Following lander integration, the PTO test program was reviewed, and several special purpose and failure-mode tests were performed to verify the design. The orbiter performed well with the exceptions noted below.

During EMI testing, the IRTM showed susceptability to relay-radio and S-band emission frequencies by an offset in all detector outputs (P/FR 34407). The primary cause of the interference was radio-frequency radiation entering into the instrument aperture and being picked up on the detector to hybrid-preamplifier wires. S-band interference was eliminated by grounding the detector center taps, making a twisted triplet of the three wires between each detector and its associated preamplifier, and closing the gap at the base of all telescopes with a silver filled epoxy fillet (ECR 17957). The requirement that the IRTM be immune to the relay-radio emission frequency was waived.

An MTCF picture recorded during the DCT-2 test showed a tooth-shaped pattern in the lower-left corner (P/FR 34417). The VIS vidicon had a manufacturing defect in its photosurface and was replaced.

Inspection of the IRTM revealed a wire with cut copper strands and insulation (P/FR 34422). A test connector mounting at the inside of the back housing cover had chafed several wires contained in the wire bundle, although

no shorts could be found. The chafed wires were repaired and steps taken to insure no recurrence of the problem (ECR 17896).

After initializing the CCS with an update and enabling the spacecraft separation routine with a command, a manually applied short to the Viking separation lines caused both CCS processors to enter the error routine (P/FR 34424). The software operated in such a way that it attempted to store a word into protected memory, resulting in a hardware error interrupt. The launch hold reset routine was altered to solve the failure (ECR 18020).

The PTO drew excessive current from the external source when the switch on the bread-board booster-regulator was placed in the 64-volt position during over-voltage testing (P/FR 34438). A broken wire in the booster-regulator permitted its output voltage to rise to about 82 VDC. All subsystem elements on board the PTO at the time of the over-voltage test were reviewed and most subsystems concluded that no damage or unacceptable risk was involved in flying the hardware even after this stress. Where components were over-stressed, those components were replaced prior to use in the flight program.

M. POST-ENVIRONMENTAL INSPECTION

On September 9, 1974 the PTO was moved from the test stand to the work stand, where an extensive disassembly and inspection began. All subsystems were cleaned, certain new spare subsystems replaced TA articles, and the orbiter, now designated VO-1, was reassembled in preparation for a final system test. No significant problems were reported during this phase.

N. PRESHIPMENT SYSTEM TEST

With VO-1 assembly completed, power was turned on Nov. 25, 1974. A month of system integration followed, during which no major problems developed. Abnormal activity was noted on the low-gain antenna while the radio was driving the high-gain antenna, but insufficient data was recorded for analysis (P/FR 34476). As the problem occurred but once, the only action taken was to request the MTC to record raw data for analysis should be problem recur.

The formal system test began Dec. 26, 1974 and proceeded smoothly to completion, only the optional MOI restore test being omitted. Radiated emissions and susceptibility tests were run in parallel with the system tests with no new anomalies, only the predicted effects.

The MAWD detector 5 output was abnormal for a period during the system test. The problem was thought to be caused by non-VO generated 381 MHz interference in SAF as documented in P/FR 34480. In any case, the interference would not be a problem in flight, and the requirement that the MAWD not be susceptible to 381 MHz was waived.

Power was turned off Jan. 10, 1075. 189 hours were put on the VO-1 during the preshipment system test, giving a total of 1510 hours at end of test. A summary of the operating time for each subsystem is given in Table 2.

O. PREPARATION AND SHIPMENT TO AFETR

After VO-1 passed the final system test and was approved for shipment, it was partially disassembled and inspected. Certain delicate items were put in their own special containers, while the orbiter was mounted on its transporter (see JPL Document VO75TOP-3-170).

Two CCS connector pins, one in the output unit module and one in the cable harness, were found damaged during disassembly (P/FRs 34496 and 34497). The pins were offset and the connectors pushed back during a previous assembly. The pins and connectors were reworked and tested.

The orbiter and support equipment left JPL Feb. 7, 1975 in route to the AFETR.

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Table 2. VO-1 Subsystem Operating Times

Subsystem	Operating Times			
RFS	S/N 204		S/N 202	
	EXC-1 76 hrs EXC-2 36 112 TWT-1 78 TWT-2 31 109 RX-1 80 RX-2 29 109 Control Unit, 110 hrs		EXC-1 27 hrs EXC-2 34 61 TWT-1 29 TWT-2 31 60 RX-1 32 RX-2 31 63 Control Unit, 62 hrs	
XTX	105 hrs, 49 min. (subsequent to rework)			
RRS	82.4 hrs in VO-1 388.6 hrs at JPL 411.6 hrs total operating time			
MDS/RTS	Unit	S/N	At SAF	Total
	TMU-A power supply TMU-B power supply CDU-A power supply CDU-B power supply	C105 C105 C101 C101 C104 C104 C104 C104	98.5 hrs 98.5 106.4 106.4 108.6 108.6 128 hrs 128	432.6 hrs 396.1 387.1 378.8 429.5 453.5 815.4 hrs 845.4

Table 2. VO-1 Subsystem Operating Times (contd)

Subsystem	Operating Times			
MDS/RTS (contd)	Unit	S/N	At SAF	Total
	RTS			
	4kb sync	C102	83	298
	power supply	C103	83	268
	16 kb sync	C102	83	393
	power supply	C104	83	288
PWR	1511 hrs.			
FDS	Subsystem Test	600 hrs through 1/9/75		
	VO-2 S/C	91		
	VO-1 S/C	179		
		870		
CCS	Unit	S/N	Total	
	Processor A/B	001/002	443 hrs	
	Output Unit 1/2	001/002	448	
	Memory C/D	003/004	92.8 hrs	
	Power Supply 3/4	007/008	84.3	
DSS	Unit	At SAF	Total	
	FLT 3 DTR	82	556	
	FLT 4 DTR	87	533	

Table 2. VO-1 Subsystem Operating Times (contd)

Subsystem	Operating Times				
ACS/ARTC	Unit	S/N	Previous System Time	Since VO-1 Build-up	System Total
	ACE-1*	006		157 hrs.	157 hrs.
	ACE-2	003	694.6 (PTO)	12	706.6
	IRU-1	003	293.6 (PTO)	69.7	363.3
	IRU-2	007		62.3	62.3
	ARTC-E	005			
	CH 1*			110.4	110.4
	CH 2			101.6	101.6
	Canopus Tracker	102	144.4 (VO-2)	112.8	257.2

VIS	Element	Time (hrs)	Shutter (cycles)	Filter (steps)
	S/N 4 S/S	211.83	13600	724
	S/N 4 VO-1	174.25	4153	426
	S/N 4 Totals	386.08	17753	1150
	S/N 7 S/S	226.90	13333	2263
	S/N 7 VO-1	35.60	637	35
	S/N 7 Totals	262.50	13970	2298

IRTM	S/N	Subsystem	System	Total
	003	309 hrs	151.7 hrs	460.7 hrs
	004	350	19.4	369.4
	005	215	70.5	285.5

*Glassivated 54L ICs.

Table 2. VO-1 Subsystem Operating Times (contd)

Subsystem	Operating Times		
MAWD	Subsystem SAF testing	500.6 hrs 15.7 516.3	(S/N 108)
PYRO	PSU PAU	915 hrs 50 cycles	

SECTION IV
VIKING ORBITER 2 TEST RESULTS

A. ORBITER INSPECTION AND ASSEMBLY

The VO-2 bus was received at the SAF on June 3, 1974. The bus was installed on a work dolly, the scan platform positioned, IRTM purge lines routed, and upper ring harness installed. The bus was then transferred to a system test stand. Assembly continued intermittently while the team members were involved with PTO system testing and space simulation. No P/FRs were initiated during this period.

B. INITIAL POWER APPLICATION

Power off checks preparatory to power turn-on were made on July 16, 1974. Initial power turn occurred six days later with a borrowed test battery from VO-1. Nearly six hours of running time produced no major problems.

C. SUBSYSTEM INTERFACE VERIFICATION AND SYSTEM INTEGRATION

Integration of the subsystems began with the power subsystem prior to initial power application and continued with other subsystems as they became available into early September 1974 (see Table 3).

During FDS integration, memory loading produced several memory verification errors (P/FR 34604), and a CCS command resulted in the wrong bit display on FDS-SE (P/FR 34635). Two FDS design flaws were discovered:

(1) The 2.4 kHz clock was susceptible to noise, resulting in double clocking of a given data bit. After several attempts at noise suppression in the 2.4 kHz circuit, the problem was finally solved (ECR 18009).

(2) Asynchronous timing existed between receipt of CCS data and internal FDS memory timing. This resulted in the FDS occasionally rejecting memory address commands during a memory block load. The problem was corrected with ECR 18100.

Table 3. VO-2 Subsystem Initial Integrations

Subsystem	Start Date	JPL Procedure
Power	7/16/74	VO75 204
Flight Data	7/23/74	VO75 206
Data Storage	7/25/74	VO75 216
Computer Command	7/26/74	VO75 205
Pyrotechnics	7/30/74	VO75 208
Articulation Control	7/31/74	VO75 215
Radio Frequency	8/5/74	VO75 202
X-Band Transmitter	8/6/74	VO75 242
Modulation-Demodulation	8/6/74	VO75 203
Relay Radio	8/9/74	VO75 252
Relay Telemetry	8/12/74	VO75 256
Visual Imaging	8/16/74	VO75 236
Attitude Control	8/21/74	VO75 207
Mars Atmospheric Water Detector	8/27/74	VO75 239
Propulsion Simulator	8/30/74	VO75 210
Infrared Thermal Mapper	9/5/74	VO75 238

While loading VIS parameters in memory A of the FDS, the content of the maneuver format was altered (P/FR 34608). The problem was traced to a shorted diode in an integrated circuit. The circuit was replaced, retested, and functioned normally.

Two problems occurred with DTR-A during integration. First, noise spikes were observed on the telemetry interface between DTR-A and FDS (P/FR 34614). The noise resulted from current transients due to both shield capacitance and signal currents. Second, DTR-A failed to respond to six out of eight commands while in the playback 4kb mode (P/FR 34616). The command failures were due to simultaneous transitions of VIS data during the flyback sequence. The transitions resulted from the combined effect of DTR motor noise and large voltage potentials between the DTR power subchassis ground and the ground at the subchassis where commands were received. Removal of a breakout box eliminated the command errors, which showed that the command

interface was marginal. Alteration of the interface shield grounding scheme (ECR 18035) reduced noise to an acceptable margin so that the DTR-A performed flawlessly, even with a breakout box installed.

The high-gain antenna actuator hit the mechanical stops before reaching electrical null when commanded below -15.91°, resulting in motor pulsing (P/FR 34615). The Antenna Pointing Operation Program was changed to restrict actuator commands to no more than -15.91°.

MDS-SE Mode 7 (LR ENG OFF) came on intermittently on TMU-B (P/FR 34629). The problem was corrected by changing the sequence in which the test operations and test software were executed.

Proper data was not obtained for the VIS-B control word during FDS integration (P/FR 34634). The problem was thought to be a part failure in the VIS sequence and control logic, but after part replacement the problem reappeared (P/FR 34654). Further investigation revealed the problem to be a marginal design condition resulting from an early design requirement which was no longer in effect. It was not considered necessary to modify the FDS to guarantee a function which was no longer used, so ECR 18023 changed the documentation to eliminate the requirement.

VIS data could not be locked on when played back (P/FR 34652). The VIS data bit sync supplied by the FDS was found to be 180° out of phase with that required by the circuit data sheets and expected by DSS. The FDS was modified to comply with the circuit data sheet timing (ECR 17950).

At DSS integration, the DST transport was noted to be at ambient pressure (P/FR 34667). No leaks could be found, and data indicated that the loss occurred during the gas sample test. The unit was later removed from SAF and pressurized to specification.

The Canopus tracker hood drove in the plus direction intermittently (P/FR 34670). The motor-drive card connector was found to have dirty contacts. The card connector was cleaned and the contacts reflowed with solder.

The IRTM data output did not contain -11 DN and -12 DN (P/FR 34672). A design flaw in the analog to pulse-width converter, whereby a signal return and a power ground were not tied together in the unit, was corrected on flight units (ECR 18034).

D. INITIAL SYSTEM TEST

The initial VO-2 system test was initiated on Sept. 16, 1974 after several days of system readiness testing. A complete system test was performed, lasting 102.2 hours. The only significant configuration compromise was the PTO radio substituting for the flight unit. Orbiter performance was generally excellent, with a few problems as explained below.

MAWD detector 5 offset values were too high during the first part of the intensity calibrate operation (P/FR 34683). The same decrease in instrument responsivity occurred twice before and was thought to be due to deposits on the head, cold lines, and detector housing. The deposits were polymers from outgassing of conformal coating. The MAWD was disassembled, cleaned, reassembled, and the grips were reset to compensate for responsivity variations between detector elements. Also, the procedures for MAWD thermal/vacuum chamber operation were modified to allow for a pump purging cycle to eliminate outgassing products prior to cooldown.

The CCS issued two erroneous commands out of 11 (P/FR 34684). This occurred after updating the CCS flight program for the VLC preseparation sequence, performing that sequence, and activating the ACE power change-over routine. The launch hold reset support macro, which had not been updated, was changed in order to update the erroneous commands.

VO block 1.8, engine venting, of the block dictionary failed to set the PSU common prior to issuing the 8C command (P/FR 34686). ECR 18031 corrected a sequencing error in block 1.8.

At various times during VO-1 and VO-2 testing, MAWD operation was disturbed. P/FR 34696 documents one case of the MAWD experiencing an uncommanded wavelength scan, and P/FR 34730 documents a raster reset

and an A/PW multiplexer step. These problems were caused by VIS turn-off transients which disturbed the MAWD logic. ECR 18092 changed the order of instrument turn-offs so that the MAWD was turned off before the VIS when both were turned off. ECR 18115 disabled suspect BCE circuits in flight hardware, thus reducing MAWD sensitivity to VIS interference.

E. SYSTEM VERIFICATION TESTS AND SYSTEM TEST

Orbiter performance was good during the system interface timing verification and the subsystem integration phases, and the system test which followed. All parts of the system test were run during 104 hours. Total VO-2 operating time increased to 494 hours.

A system radiated-emissions test and a radiated-susceptibility test were run in parallel with the system test. No unexpected radiation or susceptibility was found, and the system did reproduce the known (and waivered) susceptibilities of VO-1.

An anomaly previously reported on the PTO (P/FRs 34307, 34406, and 34415) and VO-2 (P/FR 34604) involving FDS memory errors was documented twice more (P/FRs 34711 and 34764). ECR 18100 corrected an FDS design deficiency.

During CCS integration, PWR transferred from the main to the standby power chain, and CCS failed to issue the expected safing sequence commands (P/FR 34713). This failure occurred with new CCS-regulated power supplies which required a longer processor delay than the old supplies. ECR 18055 increased the processor delay by a more than adequate margin.

At spacecraft turnon, the XTX RF output was 10.8 dB down from normal and took 38 minutes to reach the normal value (P/FR 34721). The unit was sensitive to momentary loss of 19 MHz because of a misaligned X5 multiplier. The XTX vendor performed realignment.

The Canopus tracker did not operate in closed-loop mode (P/FR 34722). The arm of the test stimulus hood was hanging up in one position for unknown reasons. Both the motor and gear-head assemblies were replaced with new units. The arm was removed and all mating surfaces cleaned and checked for burrs. The hood was reassembled and found to still hang up very slightly but not unacceptably so. The unit was assigned as a spare.

IRTM full-frame and science decommutation data indicated loss of the sign bit when the VIS was off (P/FR 34725). A previous FDS logic modification (ECR 18048) to correct a MAWD A/PW data problem inhibited the sign bit during a MAWD A/PW READ. ECR 18065 corrected the FDS design to reset the sign bit inhibit after each A/PW READ without dependency on another subsystem.

The ACS failed to respond to a manual command to control power to the coded command (CC) buffer drivers and discrete-command matrix (P/FR 34726). A design flaw bypassed the power bus switch, rendering the command useless. Isolating diodes were added to the CC drivers so that the power bus could only receive power through the switch (ECR 18066).

During power-off continuity checks on the 30-volt converter preload, a zener diode was found shorted to the orbiter chassis (P/FR 34737). Replacement of non-flight diodes for flight parts had just taken place, and an improperly used lock washer pierced the mica washer insulating the diode from the chassis. The lock washer was replaced with a flat washer, the mica washer was replaced, and the diode installed properly. Other diodes were also inspected and reinstalled where necessary.

F. SPACE SIMULATION TEST

Mechanical buildup for the solar thermal vacuum (STV) test in the space simulator began on Nov. 2, 1974, and the orbiter was moved to Building 150 four days later. Program limitations prevented a space simulation test as run on VO-1, but the following tests were performed:

(1) Complete STV test with 195 hours under vacuum. The orbiter system encountered only a few major problems described below.

(2) The CTA-21 compatibility test was run concurrently with space simulation. Although not all test criteria were met, there was no evidence of incompatibility between the VO-2 and the DSN.
(3) An attempt to measure the frame sync error rate threshold of lander relay data using analog tapes recorded at Martin-Marietta was not successful. A variety of reasons was responsible, including test equipment, improperly initialized data, and lack of VMCCC time.
(4) A weight and center-of-gravity measurement was done following space simulation, with expected results.
(5) Finally, a contamination control bioassay was performed, showing that VO-2 was within launch allowable limits.

At the conclusion of space simulator testing, VO-2 had operated a total of 708 hours. Significant problems during STV testing are described below.

The RFS-SE rack lost both uplink and downlink when the radio was turned to low-gain antenna during the system readiness test (P/FR 34743). A coaxial-connector center pin was missing, leaving the RFS TWTA-1 output driving an unterminated cable. The center pin used in this type of coaxial connected was threaded and had caused similar problems in prior programs. Based on subsequent performance of the TWTs and previous tests run on similar units, no damage was likely to have occurred. Personnel were made aware that this type of connector failure can happen, and steps were taken to insure that it would not recur.

The MAWD wavelength servo lock did not achieve lock normally at power turnon (P/FR 34753). Lock failure was due to the electro-mechanical chopper not starting at low FA temperature. The chopper did start after a slight warming of the head. Modifications to the tuning fork chopper drive/ pick-up coil eliminated the temperature dependence of the circuit (ECR 18101).

The XTX output power varied 1.6 dB (P/FR 34772). A coaxial cable running over the output isolator was found to have a broken shield braid. Also, a connector on the input isolator had lost the gold plating from its center connector. Replacement of the cable and isolator seemed to solve the problem.

During a ranging performance test with a static doppler offset, excessive range count was measured (P/FR 34744). The cause of the anomaly was not clear but was thought to be due to nonstandard CTA-21 configuration which overloaded a signal line. DSN personnel were informed of the situation, and care was taken to avoid the problem in future testing.

G. POST-ENVIRONMENTAL INSPECTION

Shortly after VO-2 was moved back to the SAF from Building 150 on Nov. 26, 1974, disassembly and inspection began. Subsystems requiring rework were returned to cognizant areas. All subsystems were cleaned and reassembled for final testing.

H. PRESHIPMENT SYSTEM TEST

VO-2 inspection was completed and power applied on Jan. 14, 1975. A complete system test was performed, interrupted by other tests:

(1) One long day was set aside for three major end-to-end tests with VO-2, CTA-21, and VMCCC. These tests were the FCT-2, the lander DAPU data interface verification, and an end-to-end on orbit pass.
(2) Several special adverse-condition tests were also run in order to simulate failure modes and exercise CCS recovery routines.

The most significant problem during the system test phase was the failure of the FDS to perform properly (P/FR 34776). When initial power was applied to the spacecraft, the FDS-SE and MTC could not sync on the data out of the FDS. The problem was caused by the cleaning process used on the FDS power converter combined with the fact that the power-converter transistors were not conformally coated. FDS subassemblies were inspected for sufficient conformal coating of transistors, and the FDS cleaning process was changed to use Freon TE instead of alcohol. Because the power converter failure overstressed the memory, the flight units were reassigned.

The ARTC cone actuator did not move or draw power (P/FR 34779). Two touching pins caused a short and blew two redundant fuses. No other damage or overstressing occurred. A bent pin was straightened, removing the short, and the fuses were replaced. The area was conformal coated and dip daubed.

The ACS-SE counter indicated a change in accelerometer pulses when the ACS was in the all-axes inertial mode and a positive turn command was being executed (P/FR 34780). The anomaly was traced to a distortion in the 6.2-volt output from the IRU power transformer from which the accelerometer clock frequency was derived. Two unused inverters in the clock circuitry were put to use to make the circuit insensitive to the distortions (ECR 18134).

Power was turned off on Jan. 31, 1975. VO-2 operated 106 hours during the preshipment system test, for a total running time of 821 hours. A summary of the operating time for each subsystem is given in Table 4.

I. PREPARATION AND SHIPMENT TO AFETR

After VO-2 passed the final system test and was approved for shipment, it was partially disassembled and inspected. Certain delicate items were put in their own special containers, while the orbiter was mounted on its transporter (see JPL Document VO75TOP-3-170). No major problems developed during this time. The orbiter and support equipment left JPL Feb. 22, 1975 in route to the AFETR.

Table 4. VO-2 Subsystem Operating Times

Subsystem	Operating Times			
RFS	EXC-1 EXC-2 TWT-1 TWT-2	307 hrs 258 hrs 565 282 279 561	RX-1 RX-2 Control Unit, 564 hrs	307 hrs 255 562
XTX	87 hrs, 16 min (subsequent to rework)			
RRS	542 hrs at JPL			
MDS/RTS	Unit	S/N	At SAF	Total
	CDU-A CDU-B TMU-A TMU-B RTS (4kb) RTS (16 kb)	C101 C105 C104 C102 C101 C101	79.5 hrs 35.2 89.5 27 42 42	996 hrs 560.3 713 633 912.7 907.7
PWR	Not reported.			
FDS (S/N 002)	Subsystem Test Subsystem Test (VO-2)		610.5 hrs 478.5 1089	
CCS (to 11/29/74, log sent to AFETR)	Unit	S/N	Time	
	Processor A/B Output Unit 1/2 Memories Power Supplies	003/004 003/004 001/002 009/010	302.8 hrs 298.8 662.3 333.3	
DSS	Unit	At SAF	STV	Total
	FLT 1 DTR FLT 2 DTR	243 hrs 226	134 hrs 128	800 hrs 843

Table 4. VO-2 Subsystem Operating Times (Cont'd)

Subsystem	Operating Times			
ACS/ARTC	Unit	S/N	Total	
	ACE-1	007	624.9 hrs	
	ACE-2	004	429.1	
	IRU-1	004	765.3	
	IRU-2	006	618.6	
	CT	103	694.7	
	ARTC-E	004	Ch 1 = 436.2 Ch 2 = 383.5	
VIS	Element	Time (hrs)	Shutter (cycles)	Filter (steps)
	S/N 5 S/S	312.90	10828	1098
	S/N 5 VO-2	51.68	3483	77
	S/N 5 Totals	364.58	14311	1175
	S/N 6 S/S	285.92	14685	1123
	S/N 6 VO-2	51.67	3644	66
	S/N 6 Totals	337.59	18329	1189
IRTM (S/N 005)	Subsystem	218.8 hrs		
	System	76.1		
		294.9		
MAWD (S/N 107) (to 11/29/74, later times not reported)	Subsystem	781.1 hrs		
	STV	51.6		
	SAF	24.4		
		857.1		
PYRO (to 11/29/74, later times not reported)	PSU	174 hrs	} in thermal vacuum	
	PAU	6 cycles		

SECTION V
PROBLEM/FAILURE REPORT SUMMARY

Tables 5, 6, and 7 summarize the major problems reported during the system testing program at JPL for the Viking orbiters. Of 706 P/FRs relating to the system test program, 169 were considered major due to having an orbiter risk (OR) or failure criticality (FC) rating of more than one.

The orbiter risk assessment was a judgement of the likelihood of a given problem recurring during flight operations:

Risk 1	Cause known, minimal risk of recurrence
Risk 2	Cause unknown, minimal risk of recurrence
Risk 3	Cause known, some risk of recurrence
Risk 4	Cause unknown, some risk of recurrence

The failure criticality rating defined the effect of the problem recurring during flight or launch operations:

Criticality 1	Negligible or no effect on mission
Criticality 2	Significantly degrading to mission
Criticality 3	Catastrophic to mission

A more thorough description of these ratings is given in JPL Document 612-33. The subsystem (S/S) numbers given in Tables 5, 6, and 7 are listed in Figure 5.

Table 5. VO-1 System Testing P/FR Summary (1 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34009	1-21-74	2004	002	3	1	POWER STANDBY BOOSTER REGULATOR BOARD COCKED. SECURE B/B WIRING BOARD IN PLACE WITH 10-32 SCREWS. NO DWG CHANGES REQUIRED FOR FLT HDW.
34013	1-22-74	2004		1	2	SE INVERTER VOLTAGE ALARM. INITIAL TURN-ON. POSSIBLY OPERATOR ERROR. NO OPEN WIRES FOUND.
34015	1-24-74	2104	001	1	2	BOOSTER REG OUT VOLT ALARM & MONITOR VOLTS LO. PROBLEM HAS NOT RECURRED. NO ACTION POSSIBLE.
34017	1-28-74	2006	BB2	2	2	TIMING PROBLEM SENDING CMDS TO FDS FROM SE. ONE TIME OCCURRANCE. CAUSE UNKNOWN. RETEST OK.
34026	2- 5-74	2005	001	3	1	MODULE D CONNECTOR PINS COATED. SOLDER FLUX. HARNESS COMPLETELY CLEANED UNDER NEW PROC.
34032	2- 8-74	2005	PT1	2	1	CCS STATUS WORD NOT SAME AS PRINTOUT/DISPLAY. ECR 17657 ALTERS CCS TO SHIFT TELEMETRY DATA ON THE TRAILING EDGE OF BIT SYNC. REDESIGNED.
34036	2-12-74	2006	BB2	2	2	NO DN ON OUTPUT OF TREE SWITCH "BE" OR "70". SUSPECT LOOSE CONNECTOR. PROBLEM DISAPPEARED.
34039	2-13-74	2006	BB2	1	2	INCORRECT DN READINGS OUT OF TREE SWITCH "75". SUSPECT LOOSE CONNECTOR. PROBLEM DISAPPEARED.
34048	2-21-74	2005		3	1	DC 75W SENT, NO RESPONSE AT BOB. NO RELAY IND. SEE COORDINATING PFR 34118 FOR CLOSURE DATA.
34056	2-23-74	2006	BB2	2	4	LAST FDS MEMORY CMD NOT STORED IN MEMORY. NO ACTION. UNABLE TO DUPLICATE PROBLEM.
34057	2-26-74	2009		1	4	OPEN CKT IN 2009W30 SCAN HARNESS, S/B 0 OHMS. NO ACTION AT THIS TIME. RETEST CABLE BEFORE COMMITMENT TO FLIGHT. REPAIR IF PROB RECURRS.

Table 5. VO-1 System Testing P/FR Summary (2 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34069	2-28-74	2005	PTO	3	2	WHITE & BLACK RESIDUE ON CCS-1 CONNECTOR PINS. FOUR BLACK PINS, CONNECTORS & JUMPER REPLACED.
34075	3- 2-74	2106	BB #2	1	2	FUS-SE NOT UPDATE MEMORY MAP, FDS IN CRUISE. PROBLEM HAS NOT RECURRED. NO ACTION TAKEN.
34078	3- 5-74	2006	BB2	1	2	NO CHANGE IN MDS STATUS BIT 3 WHEN EXPECTED. SUSPECT LOOSE CONNECTOR. PROBLEM DISAPPEARED.
34082	3- 6-74	2006	BB2	2	1	TMU B101 BLOCK DECODER NOT LOCK ON S/C DATA. IMPROPER INTERFACE DESIGN CHANGED, ECR 17741.
34085	3- 7-74	2103	1	1	2	MODE SWITCH ON CCS DWR POS 1 NOT ACQUIRE LOCK. NO CORRECTIVE ACTION, FAILURE DID NOT RECUR.
34086	3- 7-74	2000	VO-1	2	1	32KHZ REF CLOCK SHAPE CAUSING BAD WAVE SHAPES. REPLACED FDS BB WITH PTO UNIT, NO MORE PROBS.
34087	3- 7-74	2103	1	1	2	MUS-SE WOULD NOT ADVANCE BEYOND CCS MODE 2. NO CORRECTIVE ACTION. FAILURE DID NOT RECUR.
34088	3- 8-74	2116		1	3	DIR PHASE A MOTOR VOLTAGE NOT SEEN IN SE. REPAIRED BROKEN WIRE IN D/A CONNECTOR.
34089	3- 8-74	2016	001	2	1	5V PULL UP VOLTS MISSING FROM DTRB, OPEN CKT. REPAIRED BROKEN WIRE, RECONNECT TO PIN X.
34091	3- 9-74	2108	PTC	1	2	CAPACITOR BANKS HAVE +-5 ON VARIATIONS ON FDS. REVERSED AC POWER PLUG TO REDUCE 60 HZ NOISE. CORRECTED DC OFFSET (PFR 32032) & RETEST OK.
34094	3-11-74	2006	PTO	2	1	PINS C & LL SHORTED TO GROUND, FDS INTEGRATE. INTERFACE DESIGN CHANGED BY ECT 17741, RETEST.

Table 5. VO-1 System Testing P/FR Summary (3 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34105	3-14-74	2016	001	2	1	RANDOM PULSES CAUSES OFFSET IN DTR TAPE POS. SEE COORDINATING PFR 34287 FOR CLOSURE DATA.
34114	3-19-74	2006	PTO	1	3	CONTROL WORD TO MAWD NOT CONTAIN CALIB SIGNAL. REPLACED DEFECTIVE IC C3, RETESTED OK.
34118	3-20-74	2005	PTO	3	1	LOW SHORT CKT CURRENT FOUND ON 3 CCS LINES. CONNECTORS IN PROCESSOR A CLEANED. COORDINATING PFR FOR 31119, 34026, 34048, & 34069.
34124	3-21-74	2005	PTO	3	2	DC 52A CMD WIA CCS-SE D/A, CCS NOT ISSUE CMD. UNKNOWN CAUSE, REVISE SOFTWARE. USE HDW AS IS.
34126	3-21-74	2016		2	3	DSS NOT RESPOND TO CMD, PROC B CONFIG O/U-2. REF PFR 32624 FOR ANALYSIS & CLOSURE ACTION.
34129	3-21-74	2000	VO-1	2	1	TMU A STOPPED MODULATING CARRIER, DTR A OFF. ECR 17778 CHANGES DSS & MDS, REMOVE INVERSION.
34134	3-25-74	2009		1	2	CONNECTOR PIN CRYSTALIZED & BREAKING AWAY. INSERT WAS BAD. NOT PIN. REPLACED CONNECTOR.
34138	3-25-74	2105	003	1	2	START MEMORY READOUT COMMAND RESPONSE FAILURE. NO FURTHER PROBLEMS SINCE SE STS REDESIGNED.
34139	3-26-74	2016		2	3	INCORRECT DTR A RESPONSE TO 16C1321 COMMAND. SEE PFR 32624 FOR ANALYSIS & CLOSURE ACTION.
34145	3-27-74	2000	VO-1	2	1	3/V NOISE SPIKES ON 30 VDC CONVERTER OUTPUT. ADD REDUNDANT ZENER DIODES TO REDUCE TRANSIENT LEVELS. RETESTED OK. REF IOM 292-74-498.
34155	3-14-74	2003	B101	1	2	CENTRAL RECORDER INDICATES CDU OUT OF LOCK. PROBABLE CAUSE WAS OPERATOR ERROR. NO RECUR.

Table 5. VO-1 System Testing P/FR Summary (4 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34159	4- 2-74	2005	PT1	3	1	ACS PWR CHG-OVER LEVEL NOT RECOGNIZED BY CCS. ECR 17805 ALTERS S/W DESIGN TO RECOGNIZE THAT ACE POWER CHANGEOVER IS NEGATIVE LOGIC.
34167	4- 8-74	2105	03	1	2	COULD NOT LOAD FLT PROGRAM FLTB INTO DRUM. NO DEFECTS FOUND. UNIT NOW WORKING OK.
34168	4- 8-74	2000	VO-1	2	1	DTR STOPPED EARLY, AUTO SEQ WENT NORMALLY. REF ECR 17810 & 17842 FOR DESIGN & S/W CHANGE.
34172	4- 9-74	2000	VO-1	2	1	TWO ILLEGAL MODES EXIST FOR THE DSS. DESIGN PROBLEM. ECR 17805 AUTHORIZES CHANGES.
34179	4-11-74	2003	B101	1	2	BLOCK CODE ERRORS DURING 16 KBIT PLAYBACK. CAUSE UNKNOWN. NO PROBLEM RECURRANCE. UAI.
34180	4-11-74	2105	003	1	2	MANUAL CC-6B03 (CRUISE FORMAT) COMMAND FAILED. UNABLE TO REPRODUCE FAILURE. NOW WORKING OK.
34182	4- 8-74	2016		2	3	DTR B WENT INTO INCORRECT MODE, CMD RESPONSE. SEE PFR 32624 FOR ANALYSIS & CLOSURE ACTION.
34185	4- 6-74	2036		2	1	A & B PIX SHOW LINE DISTURBANCES, SYSTEM TEST. DUE TO SENSITIVITY OF VIDICON G4 MESH TO MECH SHOCK OF SHUTTER & FILTER WHEEL ACTUATION. REWORK WITH A SHOCK RESISTANT MESH. ECR 17910.
34188	4- 9-74	2103	1	1	2	CMD BIT SYNC SIGNAL PHASE DISCONTINUITIES. NO ACTION RQD. SE COMMAND BIT SYNC FREQ OK.
34194	4-15-74	2103	001	1	2	CDU SUB-CARRIER LOCK LOST, NO APPARENT REASON. CAUSE UNKNOWN. NO RECURRANCE. NO ACTION TAKEN.
34198	4-17-74	2016	001	1	2	TACH TRACK SIGNAL DROPOUT, HI-RATE DATA RCRD. PFR FOR DOCUMENTATION ONLY. USE AS IS.

Table 5. VO-1 System Testing P/FR Summary (5 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34201	4-20-74	2016	PTO	2	1	CCS PROCESSORS INTERMITTENTLY ACTIVE/INACTIVE. SEE COORDINATING PFR 34287 FOR CLOSURE DATA.
34205	4-22-74	2152		1	2	ERRATIC SIGNAL TO RRS, SWITCH IN ANT POSITION. COULD NOT DUPLICATE FAILURE IN REPEATED TESTING. ORDER SPARE COAX SWITCH AS A PRECAUTION.
34206	4-22-74	2152	3	1	2	500 MS SIGNAL DROPOUT DUE TO DEFECTIVE SWITCH. ADD COPPER SHIMS TO REDUCE MAGNETIC FORCE. REF PFR 33501 FOR DETAILED CORRECTIVE ACTION.
34208	4-24-74	2007	PTO	2	1	GIMBALS UNSTABLE & OSCILLATED, CMD TO CENTER. EXCESSIVE BACKLASH IN BALL SCREW ASSY LOT S3, REPLACED BEAVER BALL SCREWS WITH KIDDE.
34218	4-30-74	2015		2	1	CLOCK ACTUATOR PPM 001 DRIVEN AGAINST STOP. OUTPUT ADAPTER INSTALLED PROPERLY ON ACTUATOR.
34221	5- 1-74	2036	002	2	1	COULD NOT TORQUE TO 35 LBS, INSERT TURNING. SCREW TOO LONG. TORQUE OVERLOAD CAUSED INSERT TO COME LOOSE. REWORK INSERTS, REPLACE SCREWS.
34226	5- 1-74	2001		2	1	COUPLER CLOCK DRIVE, CHAMFER ON BOTH SIDES. REVISE INSTALL DWG TO SHOW PROPER ORIENTATION. CHAMFER IN KEYWAY TO BE TOWARD ACTUATOR & KEY.
34241	5- 8-74	2001		2	1	CUTOUT IN PROP BLANKET RIDES ON VSCA MOUNTING. FOOT PRINT FOR VSCA CUTOUT IN ERROR. BLANKETS REWORKED PRIOR TO PTO STV TEST, CERTIFIED OK.
34246	5- 9-74	2002	002	3	1	TWTA #2 DID NOT TURN ON AFTER WARMUP TIME. MECHANICAL SHORT DUE TO TOLERANCE BUILDUPS IN REGULATOR, NO HARDWARE STRESS. REWORKED OK.

Table 5. VO-1 System Testing P/FR Summary (6 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34261	5-11-74	2105	003	1	2	ACCUMULATOR WORD FROM CCS-SE WRONG. RESEND OK. RANDOM PROBLEM. FAULT ISOLATION ADEQUATE. UAI.
34263	5-14-74	2001		2	1	SUNGATE CUTOUT IN BAY 5 THERMAL BLANKET SHIFT. ADDITIONAL TIE ADDED TO RETAIN BLANKET.
34264	5-14-74	2001		2	1	SCAN PLATFORM THERMAL BLANKET STRING TIES. ADDED 4 SCREWS TO SUPPORT BLANKET IN INSERT.
34267	5-15-74	2002	201	1	2	RECEIVER #202, E-039 DN VARIES DUR ACOUSTIC. HFS PERFORMANCE ACCEPTABLE. NO ACTION RQD.
34269	5-16-74	2016	001	1	3	UNABLE TO MAINTAIN BIT SYNC LOCK DURING VIB. NO ACTION, TYPICAL PERFORMANCE OR DTR IN VIB.
34270	5-16-74	2000	VO-1	1	3	TLM CHANNELS DECREASED WITH LANDER RADIO ON. INCORRECT READINGS WERE FROM PRESSURE TRANSDUCERS. OPERATIONAL WORK AROUND. REVISE TESTING.
34271	5-16-74	2102	001	1	2	POWER LEVEL DIFFERS & NON-LINEARITIES SEEN. EXACT CAUSE UNKNOWN. CONTINUE TO MONITOR.
34276	5-22-74	2077	003	1	2	FILL VALVE HANDLE CAVITY LEAK FOUND BY SNOOP. CLEAN & REASSEMBLE WITH NEW O-RINGS. RETESTED.
34287	5-31-74	2016	002	2	1	RANDOM PULSES ON TACH CLK MON & CCS TAPE LINE. REDESIGN TACH AMP, ADD TACK CLOCK GATE TIMER.
34293	6- 3-74	2002	201	1	2	INTERMITTENT SAWTOOTH ON TWT #1 HELIX CURRENT. NORMAL HICCUPPING PROBLEM. NOT UNDERSTOOD. NO ACTION REQUIRED. REF MM'71 PFR 100795.
34295	6- 5-74	2016		2	3	DTR A FAILED TO RESPOND TO AUTO CCS COMMAND. SEE PFR 32624 FOR ANALYSIS & CLOSURE ACTION.

Table 5. VO-1 System Testing P/FR Summary (7 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34298	6- 5-74	2038	002	2	1	IRTM D DETECTOR CHANNELS CHGD INTERMITTENTLY. A/PW CONVERTER SIGNAL & POWER RETURN NOT TIED TOGETHER IN UNIT. ECR 18034 REWORKS FLT UNITS.
34302	6-10-74	2016	PTO-2	2	1	DTR B MISSING TAPE INCREMENT/DECREMENT PULSES.
34307	6-11-74	2006	PTO	2	1	3 A MEMORY VERIFY ERRORS, VIS PARAMETER LOAD. ECR 18100 TO CORRECT FDS DESIGN DEFICIENCY.
34311	6-12-74	2002	201	1	2	RCVR #1 2.4 KHZ I VARIED UNTIL FIRST MDS CMD. NO RFS DEGRADATION, NO RECURRANCES. NO ACTION.
34329	6-24-74	2012	PTO	2	2	CCS NOT ISSUE V-S/C SEPARATION TLM PROC WORD. EXACT CAUSE UNKNOWN. REF IOM OTTH/LEWIS 11/18.
34331	6-24-74	2104	201	1	2	BATTERY #1 CELL VOLTAGE READS ABOVE NORMAL. 2 BLOWN FUSES CAUSED PROBLEM. SPARE SCANNER CARD USED IN SE INSTEAD OF SUSPECT CARD.
34333	6-25-74	2104	001	1	2	PWR-SE DATA SYSTEM CH 43 READ -9V, S/B +1.4V. PROBLEM DISAPPEARED. SPARE CARD USED IN SE.
34341	6-29-74	2000	VO-1	1	3	SEC 4 REACHED A MECHANICAL STOP, SLEW UNTERM. DUE TO BUILDUP OF TOLERANCES. REVISE CMDS.
34342	6-30-74	2103	1	1	2	RTS CONTROL & DISPLAY CHAN A OUTPUT LEVEL LOW. NO RECURRANCE OF PROBLEM, NO ACTION TAKEN.
34344	6-28-74	2016	PTO1	2	3	DTR PERFORMANCE DEGRADED, DATA RECOVERY IMPOS. SEE COORDINATING PFR 32631 FOR CLOSURE DATA.
34348	6- 7-74	2042	002	1	2	XTX RF TOGGLES BETWEEN -2.1 DMB & -1.9 DBM. CAUSE UNKNOWN. NO ACTION. SEE ALSO PFR 34297.

Table 5. VO-1 System Testing P/FR Summary (8 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34350	7- 7-74	2002	201	1	2	TWT HELIX CURRENT CHANGED 5 DN FROM ON TO OFF. NO ACTION REQUIRED. CHANGE IN HELIX WITH RANGING ON/OFF CHARACTERISTIC. REF 69 PFR 204665.
34351	7- 7-74	2000	VO-1	1	2	MAWD OPTIC HEATER 85% ON, HIGH FOR HEATER PWR. ADD 2 WATTS TO HEATER ON MAWD SIDE, RETEST OK.
34374	7- 9-74	2016	PTO	2	1	WHILE DTR B IN READY MODE TIC VALVE ERRATIC. REDESIGN TACH AMP, ADD TACH CLOCK GATE TIMER.
34379	7-17-74	2052	201	1	2	RRS-RCVR AGC LOOP GAIN DRIFTING SINCE S/S T/V. NORMAL OPERATION, AGC STABILIZATION OK. UAI.
34385	7-19-74	2102	001	1	2	S/C RECEIVER DPE INCREASES MAG BY 3 TIMES. CAUSE UNKNOWN, UNABLE TO REPEAT PROBLEM. UAI.
34386	7-19-74	2104	01	1	2	EXTERNAL PWR INDICATOR ON WHEN S/C PWR ON. LAMP & RELAY REPLACED, UNIT RETESTED OK.
34391	7-21-74	2000	VO-1	1	3	POOR DATA RETRIEVAL ON PLAYBACK OF DTR A. TAPE DROPOUTS. REPLACE TAPE IF DTR FLOWN.
34404	8- 6-74	2105	003	1	2	COULDN'T BOOTSTRAP INTO SE MEMORY SE SYS TAPE. PROBABLY POOR CONTACT. UNIT FUNCTIONING OK.
34406	8- 6-74	2006	PTC	2	1	SWITCH SC LOADED INTO WRONG MEMORY LOC A-1316. SAME ANALYSIS & CLOSURE ACTION AS PFR 31505.
34407	8- 6-74	2038	003	2	1	IRTM SUSCEPTABLE TO RELAY RADIO & S-BAND FREQ. GROUNDED DETECTOR CENTER TAPS. REF ECR 17957.
34415	8- 8-74	2006	PTO	2	1	FUS BLOCK LOAD VIA CCS LOADED W/ WRONG SWITCH. SAME ANALYSIS & CLOSURE ACTION AS PFR 31505.

Table 5. VO-1 System Testing P/FR Summary (9 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34417	7-22-74	2036		1	2	MTCF PICTURE SHOWS TOOTH-SHAPED PATTERN. MFG DEFECTS IN VIDICON PHOTOSURFACE. REPLACED.
34419	8-13-74	2004		1	2	MISSING SCREW ON S/P PWR HARNESS TEFLON CLAMP. NO ACTION RQD. NO FURTHER USE THIS PROGRAM.
34422	8- 9-74	2038	002	2	1	IRTM ASSY 002. WIRE HAS INSUL & COPPER CUT. CONNECTOR MOUNTING NUT CHAFFED WIRES. REWORK.
34423	8-20-74	2038	001	1	2	XENON BACK FILL PLUG LOOSE. THERMAL MAPPER 1. REFILL & TIGHTEN PLUG. RETEST OK. NO LEAKAGE.
34424	8-19-74	2005	PT142	2	1	MANUAL SHORT TO PAS-B LINES. ERROR ROUTINES. LAUNCH HOLD RESET ROUTINE ALTERED. ECR 18020.
34429	8-22-74	2016	001	2	1	TIC OFFSET ACCUMULATION. BOT READING 252. REDESIGN TACH AMP & ADDED TACH CLOCK GATE.
34430	8-23-74	2004	VO-1	1	2	MULTIPLE BOOST PULSES OBSERVED AT POWER-SE, DUE TO INTERMITTENT FAILURE IN SUB-MODULE AND NOT A DESIGN DEFICIENCY. USE AS FLIGHT SPARE.
34438	8-29-74	2000	VO-1	3	1	S/C UREW EXCESS CURRENT. SW IN 64 V POSITION. DUE TO BROKEN WIRE IN REGULATOR ALLOWING VOLTS TO RISE TO 82 VDC. REPLACE OVERSTRESSED HDW.
34440	9- 5-74	2006	PTO	1	2	"NO GO" INDICATION IN 2.4 KHZ FREQ VARY TEST. REPLACED OSCILLATING OP AMP. TROUBLE CLEARED. NO DEFECTS FOUND IN OP AMP. NO FLIGHT USE.
34453	9-20-74	2009		1	2	EAB HARNESS 002 WIRE INSULATION DAMAGED. WRAP WITH TEFLON TAPE. CAUTION PERSONNEL.
34455	9-25-74	2015		1	2	OIL RESIDUE ON SCAN CLOCK ACTUATOR SHAFT. NO ACTION. OIL CAME FROM OUTSIDE THE ACTUATOR.

Table 5. VO-1 System Testing P/FR Summary (10 of 10)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34460	11-22-74	2015		1	4	INTERMITTENT CLOCK ACTUATOR #109 NOISE. NORMAL HARDWARE OPERATION. NO ACTION REQUIRED.
34462	11-27-74	2004		1	2	HGA ELEVATION ACTUATOR HEATER FUSES OPEN. EXACT CAUSE NOT DETERMINED. REPLACED FUSES.
34466	12- 5-74	2003	C101	1	2	TMU B C101 COMPOSITE TELEM VMB OUTPUT VOLTS. REVISED INTEG & TEST PROCEDURE SO THAT TMU CKT COMMON CONNECTED TO S/C BEFORE POWER ON.
34476	12-17-74	2000	VO-1	1	2	ABNORMAL ACTIVITY NOTED ON LOW GAIN ANTENNA.
34481	12-26-74	2000	VO-1	1	2	MAWD LEVEL ABNORMAL UNTIL IRTM 2.4KHZ PWR OFF. WAIVER 26410 WRITTEN. REF PFRS 34480 & 34683.
34488	12-19-74	2000	VO-1	1	2	EXCESSIVE BIT ERRORS. RFS #202 & TMU #C102. EXACT CAUSE UNKNOWN. SUSPECT TEST EQUIPMENT. NO ACTION REQUIRED. EXTENDED RETESTING OK.
34491	1- 7-75	2002	202	1	2	INCREASE IN LOOP STRESS. AGC MORE NEGATIVE. PROBLEM CAN NOT OCCUR IN FLIGHT. NO ACTION.
34495	1- 9-75	2105	002	1	2	BLOCK LOAD TO UPDATE CCS MEMORY NOT COMPLETE. COULD NOT DUPLICATE PROBLEM. REPLACE CASSETTE.
34496	1-11-75	2005		2	1	BENT PIN ON OUTPUT UNIT PUSHED CABLE PIN BACK. STRAIGHTEN BENT PIN. TEST OK WITH CONN SAVER.
34497	1-11-75	2009		2	1	DAMAGED PIN #4 ON CONNECTOR 20050U2P1. REPAIR HARNESS BY REPLACING BAD CONNECTOR.

Table 6. VO-2 System Testing P/FR Summary (1 of 5)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34604	7-23-74	2006	001	2	1	SEVERAL MEMORY VERIFY ERRORS. A & B MEMORIES. SAME ANALYSIS & CLOSURE ACTION AS PFR 31505.
34607	7-24-74	2000	VO-2	1	3	PWR STATUS II WORD READ LOW. FDS POWER INTEG. DUE TO COUPLING. OK WITH BREAKOUT BOX GONE.
34608	7-25-74	2006	001	2	1	MANEUVER FORMAT CONTENTS ALTERED DURING LOAD. REPLACED DEFECTIVE IC U72. RETESTED OK.
34610	7-29-74	2105	002	1	2	CCS SE CPU WENT TO STEP MODE VIA AUTO MODE. NO PROBLEMS SINCE USING OWN DRUM & NOT FDS-SE.
34614	8- 2-74	2000	VO-2	2	1	NOISE SPIKES SEEN DURING FDS-DSS INTEGRATION. ECR 18035 ALTERS VIS DATA SHIELD GROUNDING.
34615	8- 2-74	2000	VO-2	1	3	ACTUATOR CANNOT BE COMMANDED BELOW 0010. REVISE ANTENNA POINTING OPERATION PROGRAM.
34616	8- 2-74	2016	004	2	1	DTR FAILED TO RESPOND TO 6 OUT OF 8 COMMANDS. REMOVE VIS DATA SHIELD PER ECR 18035.
34618	8- 6-74	2004	VO-2	1	2	FAIL SENSE #1 LIGHTS WHEN TWTA #1 SWITCHED. DUE TO GROUNDING. NO FURTHER PROBLEMS. UAI.
34624	8- 8-74	2152	1	1	2	+5VDC POWER SUPPLY BLOWS 115 VAC INPUT FUSE. REPLACE FAST FUSE W/ SLOW BLOW. KEPT AS SPARE.
34627	8- 9-74	2152		1	2	REED SCANNER FAILS TO COMPLETE SCAN OF REQ CH. SCAN MODULES INTERCHANGED. PROBLEM CORRECTED.
34629	8- 8-74	2003	C102	2	1	MDS-SE MODE 7 CAME ON INTERMITTENTLY ON TMU B. REVISED TEST PROCEDURE & MTC STCE TOS.
34633	8-12-74	2103	2	1	2	RTS LOOSE LOCK DUE TO SE OSCILLATOR INSTABLE. EXACT CAUSE NOT FOUND. NO FURTHER PROBLEMS.

Table 6. VO-2 System Testing P/FR Summary (2 of 5)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34635	8-15-74	2006	002	2	1	COMMAND 6B10 GIVEN TO FDS. WRONG BIT DISPLAY. SAME ANALYSIS & CLOSURE ACTION AS PFR 31505.
34645	8-12-74	2002	203	1	2	TWTA #1 ANODE VOLT TLM CHG. DAY 221 TO 224. NO CORRECTIVE ACTION THIS PROBLEM. REF 34535.
34651	8-28-74	2039	106	1	3	DN READINGS OF S MAWD #106 DETECTORS UNEVEN. SEE COORDINATING PFR 30895 FOR CLOSURE ACTION.
34652	8-30-74	2000	VO-2	2	1	VIS DATA COULD NOT BE LOCKED ON, CH 1, 2 & 5. ECR 17950 MODIFIED FDS, COMPLY W/ CKT TIMING.
34654	9- 4-74	2006	002	1	3	VIS B DATA WORDS- SOMETIMES 4, SOMETIMES LESS. ECR 18023 ELIMINATES FUNCTION. ACCEPT AS IS.
34667	9-10-74	2016	03	1	4	DST TRANSPORT #005 NOTED AT AMBIENT PRESSURE. PROBABLY PRESSURE LOSS DURING GAS SAMPLE TEST. WILL PRESSURIZE UNIT TO 17-18 PSI. NO LEAKS.
34670	9-10-74	2107		1	2	C/T HOOD INTERMITTENT NOT DRIVE + DIRECTION. CLEANED DIRTY MOTOR DRIVE CARD CONNECTOR.
34672	9- 6-74	2038	004	2	1	DATA OUTPUT HAS A DEADBAND, NO -11 OR -12 DN. DESIGN PROBLEM IN A/PW CONVERTER. ECR 18034.
34673	9-11-74	2103	004	1	2	DRAWER LOGIC RESET WHEN UPPER TRAY LIFTED. UNABLE TO DUPLICATE PROBLEM. NO ACTION TAKEN.
34674	9-11-74	2002	201	1	2	TWT #1, ONE DN FLUCTUATIONS IN TLM S-HI DRIVE. RFS PERFORMANCE OK. NO ACTION REQUIRED.
34676	9-11-74	2042	003	1	2	SPURS IN X-BAND SPECTRUM, 1 MIN AFTER TURN ON. DUE TO SLIGHT DIFFERENCES IN INTERNAL FILTERING. NO SCIENCE EXPERIMENT DEGRADATION. UAI.

Table 6. VO-2 System Testing P/FR Summary (3 of 5)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34683	9-17-74	2039	106	1	3	DETECTOR 5 OFFSET VALUES TOO HIGH. 3 TESTS. REF COORDINATING PFR 30895 FOR CLOSURE ACTION.
34684	9-13-74	2005	001/2	2	1	WRONG CMDS ISSUED AFTER UPDATING FLT PROGRAM. UPDATE LAUNCH HOLD RESET SUPPORT MACRO TO UPDATE CC7B & CC7D CMDS AFTER C/T POWER ON.
34686	9-18-74	2000	VO-2	2	1	ANOMALOUS VO BLOCK 1.8 OF DICT, ENGINE VENT. ECR 18031 CORRECTS SEQUENCE ERROR.
34692	9-23-74	2016	FLT-1	1	2	UNABLE TO RECOVER VIS DATA IN PLAYBACK 1 KBPS. TACH OUT-OF-LOCK PROBLEM. REMOVE BIT ERROR RATE REQUIREMENT AT 1 KBPS. REF ECR 17433.
34696	9-25-74	2000	VO-2	1	4	WAVE LENGTH SCAN W/O COMMAND, PWR LEVEL DROP. REF COORDINATING PFR 34730 FOR CLOSURE ACTION.
34704	9-30-74	2103	2	1	2	MUS PRINTER PRINTED DATE & TIME. CCS SENT CMD. STCE WAS OPERATING IN NON-STANDARD MODE. WILL DEACTIVATE CMD MODULES. SOFTWARE DESIGN OK.
34711	10- 7-74	2006	002	2	1	FUS APPEARS TO HAVE MISSED SEVERAL COMMANDS. ECR 18100 CORRECTS DESIGN DEFICIENCY. SEE ALSO PFRS 34307, 34764, 34406, 34415 AND 34604.
34713	10- 9-74	2005	003/4	3	1	PWR TRANSFERRED TO STANDBY, NO SAFING SEQ CMD. ECR 18055 INCREASES PROCESSOR DELAY. TEST OK.
34714	10-11-74	2039	107	2	1	CALIBRATION MIRROR UNLATCHED WHEN RECEIVED. CAL MIRROR NOT IN PROPER POSITION WHEN LATCH WAS LATCHED. QA TO SEE PROBLEM DOES NOT RECUR.
34716	10- 9-74	2002	203	1	4	HELIX I ON VARIES BETWEEN 34 AND 37, MODE 304. IWTA S/N 023 REPLACED WITH ANOTHER UNIT.

Table 6. VO-2 System Testing P/FR Summary (4 of 5)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34721	10-17-74	2042	004	2	3	RF OUTPUT +12.7 DBM, DOWN 10.8 FROM NORMAL. REALIGNED X5 MULTIPLIER FOR MAX POWER OUT.
34722	10-17-74	2107	STS2	1	2	CT HOOD DRIVE NOT OPERATE CLOSED LOOP MODE. MOTOR & GEAR HEAD ASSEMBLIES REPLACED, MATING SURFACES CLEANED. HOOD RETESTED OK.
34725	10-17-74	2006	002	2	1	IRTM DATA INDICATES SIGN BIT LOSS W/ VIS OFF. PROBLEM TRACED TO ECR 18048 MODIFICATION TO CORRECT MAWD DATA. ECR 18065 CORRECTS DESIGN.
34726	10-18-74	2005	001/2	3	1	ACS FAILED TO RESPOND TO MANUAL CC7D110U CMD. ECR 18066 ADDS ISOLATING DIODES. RETESTED OK.
34727	10-18-74	2000	VO-2	1	2	CMD DATA INTERFACE CDU & CCS, 3 VOLT LEVELS. EXACT CAUSE NOT FOUND. RETEST OK. USE AS IS.
34730	10-23-74	2000	VO-2	1	4	MAWD RASTER RESET WITH VIS A ORB TURN-OFF. ECRS 18092 & 18115 REVISE CKT & TURNOFF ORDER.
34731	10-28-74	2002	203	1	4	EXC #1 TWT DR DROPPED FROM 104 DN TO 101 DN. RFS PERFORMANCE IS ACCEPTABLE. USE AS IS.
34732	10-29-74	2177	004/05	1	2	GAS USAGE RATE OF RCA 1 & RCA 2 DIFFERENT. ALL FLEXLINES TO BE LEAK CHECKED AT 35 PSIG.
34734	10-30-74	2042	2	1	2	S-X PHASE DELTA CHANGES, -73.3 TO +128.7 DEG. DUE TO INSUFFICIENT WARMUP TIME. RETEST OK.
34737	11- 1-74	2001	002	3	1	30V CONVERTER CHECK, ZENER SHORTED TO CHASSIS. LOCK WASHER PIERCED MICA. REINSTALL DIODE.
34739	10-29-74	2000	VO-2	1	3	TIC READOUTS DIFFER AS MUCH AS THREE TICS. DUE TO DTR TIC COUNTER LOGIC DESIGN. UAI. MISSION CONSTRAINT, MINIMIZE ON/OFF CYCLES.

Table 6. VO-2 System Testing P/FR Summary (5 of 5)

PFR NO.	PFR DATE	S/S	S/N	F C	O R	SUMMARY
34743	11-11-74	2002	203	3	1	SE RACK LOST UPLINK & DOWNLINK. MISSING PIN. PIN UNSCREWED. ADVISE PERSONNEL OF PROCEDURE.
34753	11-16-74	2039	107	2	1	WAVE LENGTH SERVO LOCK DID NOT LOCK NORMALLY. REF COORDINATING PFR 33339 FOR CLOSURE ACTION.
34755	11-17-74	2038	005	1	3	THERMAL TRANSIENT FUNCTION OF IRTM MIRROR POS. INITIATE PROCEDURES FOR DATA NORMALIZATION.
34759	11-16-74	2002	203	1	2	RANDOM 90 DEG SPIKES DURING FA COLD TESTING. PROBABLE CAUSE ELECTROMAGNETIC INTERFERENCE. NO DEGRADATION IN RFS PERFORMANCE. USE AS IS.
34764	11-19-74	2006	002	2	1	MEMORY VERIFY ERRORS AFTER CCS BLOCK LOAD. ECR 18100 TO CORRECT FDS DESIGN DEFICIENCY.
34772	10-15-74	2042	VO-2	2	2	CHANGES OF 1.6 DB IN XTX 003 OUTPUT POWER. REPLACED 1684 MHZ ISOLATOR & COAX CABLE.
34773	9- 4-74	2016	FLT-1	1	2	MTC LOST SYNC ON FLT 1 DTRA 16KB FWD PLAYBACK. EXACT CAUSE UNKNOWN. PROBLEM NOT RECUR. UAI.
34774	11-19-74	2000	VO-2	2	2	EXCESS RANGE COUNT (DRVID) MEASURED. PROBABLY DUE TO NON-STANDARD CTA-21 CONFIGURATION. RETESTED OK. CAUTION DSN PERSONNEL.
34779	1-15-75	2015		2	1	ACTUATOR NOT MOVE OR DRAW POWER ON COMMAND. SHORT ON CONE ACTUATOR CONNECTOR BLEW FUSES. REPLACED FUSES. REMOVED SHORT. CONFORMAL COAT.
34780	1-17-75	2007		2	1	SE COUNTER INDICATES CHG IN ACCEL PULSES. DUE TO DISTORTION IN 6.2V OUTPUT FROM IRU PWR TRANSFORMER. ECR 18134 REDESIGNS CIRCUIT.
34786	1-21-75	2042	VO-2	1	2	XTX RF PWR OUTPUT READ 94 DN, USUALLY 80 DN. EXACT CAUSE UNKNOWN. NO RECURRANCES. UAI.

Table 7. VO-3 System Testing P/FR Summary

PFR NO.	PFR DATE	S/S	S/N	FC	OR	SUMMARY
35003	9-11-74	2010	005	1	3	PRESSURE LEAK AFTER SCAN LATCH PRESSURIZED. CONTAMINATED MANIFOLD CLEANED. RETESTED OK.
35007	9-19-74	2006	003	2	1	FDS-SE INDICATED "A" MEMORY POWER FAILURE. REWORKED PWR CONVERTER. CONFORMAL COAT. TEST.
35008	9-20-74	2006	003	3	3	2.4KHZ REF FROM FDS TO FDS-SE WAS MISSING. IC U64 FAILED. HAD BEEN RECENTLY INSERTED PER ECR 18009. REPLACED IC & RETESTED OK.
35009	9-24-74	2004		2	2	NO VOLTAGE ON XTX UNREGULATED DC VOLT OUTPUT. FUSES F12 & 13 BLOWN. CAUSE UNKNOWN. REPLACED WITH SCREENED PARTS. REPAIR CONFORMAL COAT.
35011	9-20-74	2000	VO-3	1	3	POWER STATUS WORDS E075 & E076 READINGS WRONG. SEE ALSO PFRS 34023 & 34607. ECR 17782 WAS NOT APPROVED DUE TO COST. SYSTEM WORKS OK W/O BOB.

APPENDIX A

GLOSSARY

APPENDIX A
GLOSSARY

ACE	attitude control electronics
ACS	attitude control subsystem
AFETR	Air Force Eastern Test Range
AGC	automatic gain control
AGE	aerospace ground equipment
AHSE	assembly, handling, and shipping equipment
AO	Building AO (AFETR Spacecraft Checkout Facility)
A/PW	analog to pulse width
ARTC	articulation control subsystem
B/R	booster-regulator
BCE	bench checkout equipment
BOB	breakout box
CABL	cabling subsystem
CC	coded command
CCS	computer command subsystem
CCWG	Contamination Control Working Group
CDU	command detector unit
CRS	central recorder subsystem
CTA-21	Compatibility Test Area 21 (DSN)
CT	Canopus tracker
CTS	central timing subsystem
DAPU	data acquisition and processor unit
DC	discrete command
DCT	data compatibility test
DEV	mechanical devices subsystem
DN	data number
DFRJ	dual-frequency rotary joint
DSN	Deep Space Network
DSS	data storage subsystem
DTM	developmental test model
DTR	digital tape recorder

ECI	Engineering Change Instruction
ECR	Engineering Change Request
EMC	electromagnetic compatibility
ETL	Environmental Test Laboratory (JPL)
ESA	Explosive Safe Area (AFETR)
ETR	Eastern Test Range
EMI	electromagnetic interference
E^2M^2	emergency early midcourse maneuver
EXC	exciter
FA	flight acceptance
FC	failure criticality
FCT	flight compatibility test
FDS	flight data subsystem
FED	flight events demonstration
GMT	Greenwich Mean Time
HGA	high-gain antenna
IC	integrated circuit
IRTM	infrared thermal mapper subsystem
IRU	inertial reference unit
ITL	integrate-transfer-launch
JPL	Jet Propulsion Laboratory, Pasadena, CA
KSC	Kennedy Spaceflight Center
LCET	launch complex equipment trailer
LP	low pressure
LP-41	launch pad at AFETR
LPM	low pressure module
LRC	Langley Research Center
L/V	launch vehicle
MAWD	Mars atmospheric water detector subsystem
MDS	modulation demodulation subsystem
MIL-71	Merrit Island Launch Area (DSN/STDN station)

MOI	Mars orbit insertion
MMC	Martin-Marietta Corporation
MTC	Mission and Test Computer
MTCF	Mission and Test Computer Facility
MTCS	mission and test computer system (MTCF)
MTVS	mission and test video system (MTCF)
OPAG	Orbiter Performance Analysis Group (at JPL)
OR	orbiter risk
PAU	propulsion actuator unit
PCE	power conversion equipment
P/FR	Problem/Failure Report
PROP	propulsion subsystem
PSU	pyrotechnic switching unit
PTO	proof-test orbiter (VO-1)
PWR	power subsystem
PYRO	pyrotechnic subsystem
QA	quality assurance
RAS	relay antenna subsystem
R-C	resistance-capacitance
RCA	reaction control assembly
RCVR	receiver
RF	radio frequency
RFS	radio frequency subsystem
R&R	removal and reinstallation
R/RC	removal/recertification form
RRS	relay radio subsystem
RTG	radioisotope thermoelectric generator
RTS	relay telemetry subsystem
RX	receiver
SAEB	Spacecraft Assembly and Encapsulation Building (SAEF)
SAEF	Spacecraft Assembly and Encapsulation Facility (AFETR)
SAF	Spacecraft Assembly Facility (JPL)

SCF	Spacecraft Checkout Facility (AFETR)
SCR	Software Change Request
SE	support equipment
SEC	solar energy collector
SNORE	signal-to-noise ratio estimator
SRT	system readiness test
STC	system test complex
S&A	sterilization and assembly
S/C	spacecraft
S/N	serial number
S/S	subsystem
STRU	structure subsystem
STV	solar thermal vacuum
SVT	solar vacuum tests
TA	type approval
TIC	tape increment count (in DSS)
TMEM	transport-mounted electronic module
TMU	telemetry modulation unit
TOP	Test and Operations Plan
TWT	traveling wave tube
TWTA	traveling wave tube amplifier
UES	Universal Environmental Shelter
UHF	ultra-high frequency
VIS	visual imaging subsystem
VL	Viking lander
VLC	Viking lander capsule (including lander and bioshield)
VLCA	Viking lander capsule adapter
VMCCC	Viking mission computing and control center
VO	Viking orbiter
VO75	Viking 1975 orbiter
VSCA	Viking spacecraft adapter
XTX	X-band transmitter subsystem

APPENDIX B

REFERENCE DOCUMENTS

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REFERENCE DOCUMENTS

The following JPL documents contain information useful to understanding the Viking orbiter 75 system test program:

1. Documents

612-22	Viking 75 Orbiter, Test and Operations Plan
612-23	Viking 75 Orbiter, Problem Failure Reporting and Analysis Program
VO75-3-120	Functional Requirement, Viking Orbiter 1975 Flight Sequence Implementation
VO75-4-1270	Functional Requirement, Viking 75 Orbiter Support Equipment Test Facilities
VO75TOP-3-170	Viking 75 Orbiter, Test and Operations Plan, Logistics

2. Drawings

10050600	Cabling Block Diagram, System Test Complex Equipment
10058972	SAF Layout, Viking 75 High Bay and North Wing
10058974	SAF Building 179, South Wing and Partial High Bay, VO75 STC Layout

3. Procedures

QAP 60.1 through 60.12	Quality assurance
VO75 100 series	Mechanical operations and tests
VO75 200 series	Subsystem integration and tests
VO75 300 series	System tests
VO75 400 series	Interface tests
VO75 501	Contamination control
VO75 502	Microbiolcgical sampling